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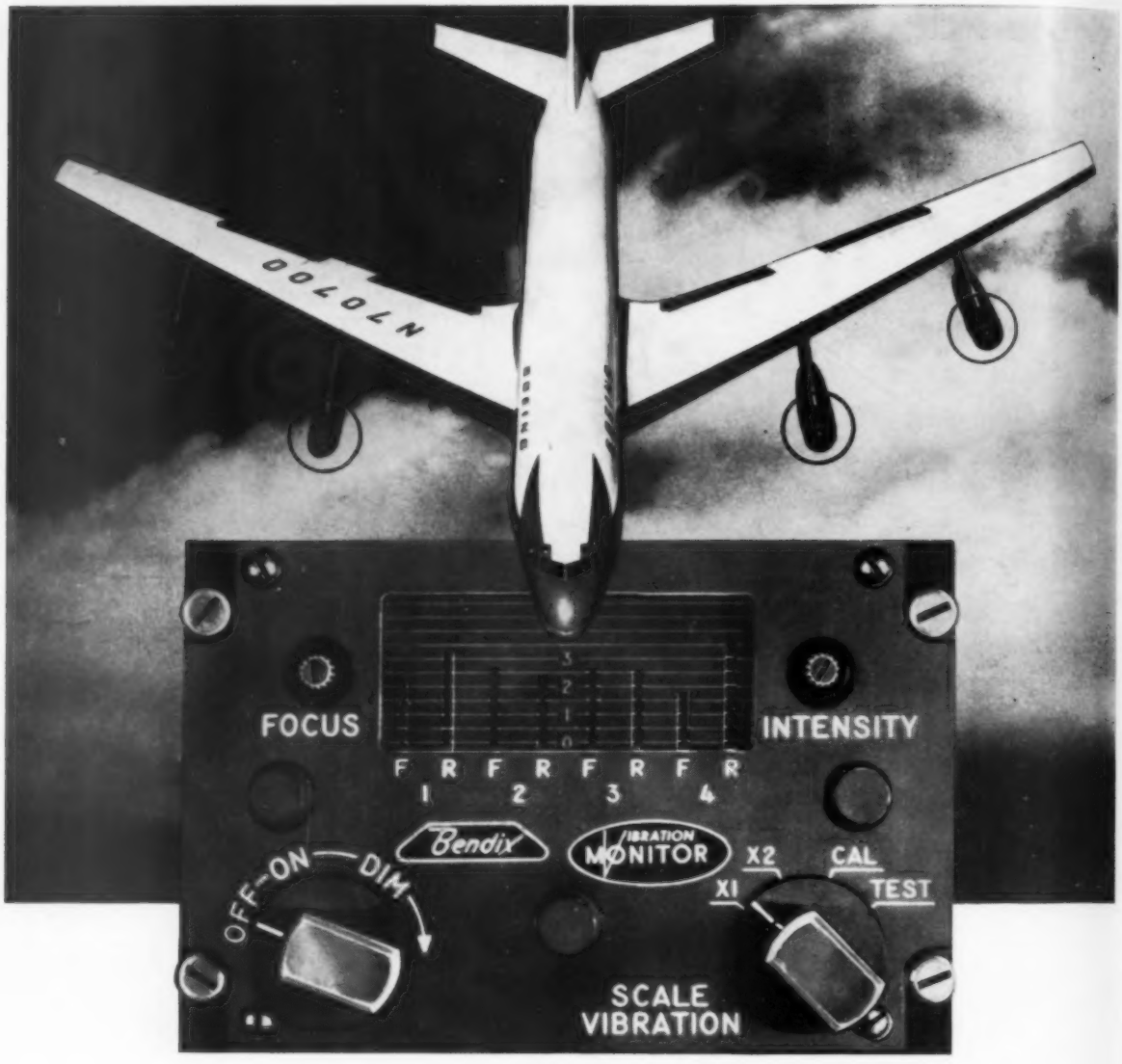

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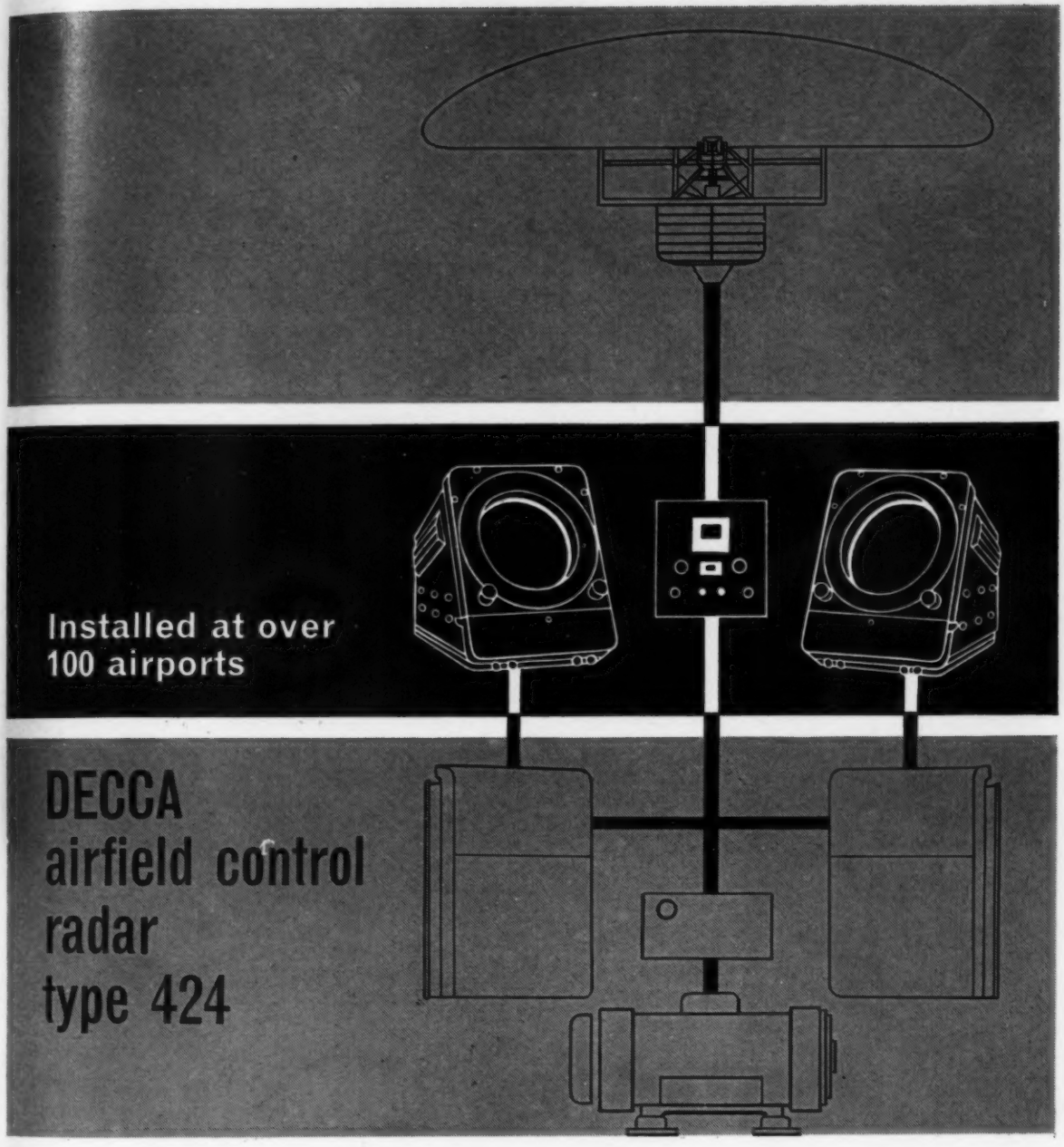

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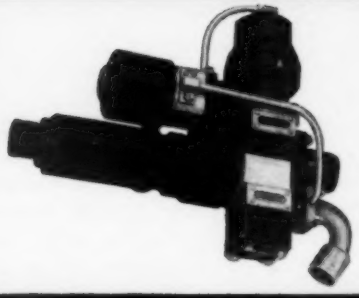

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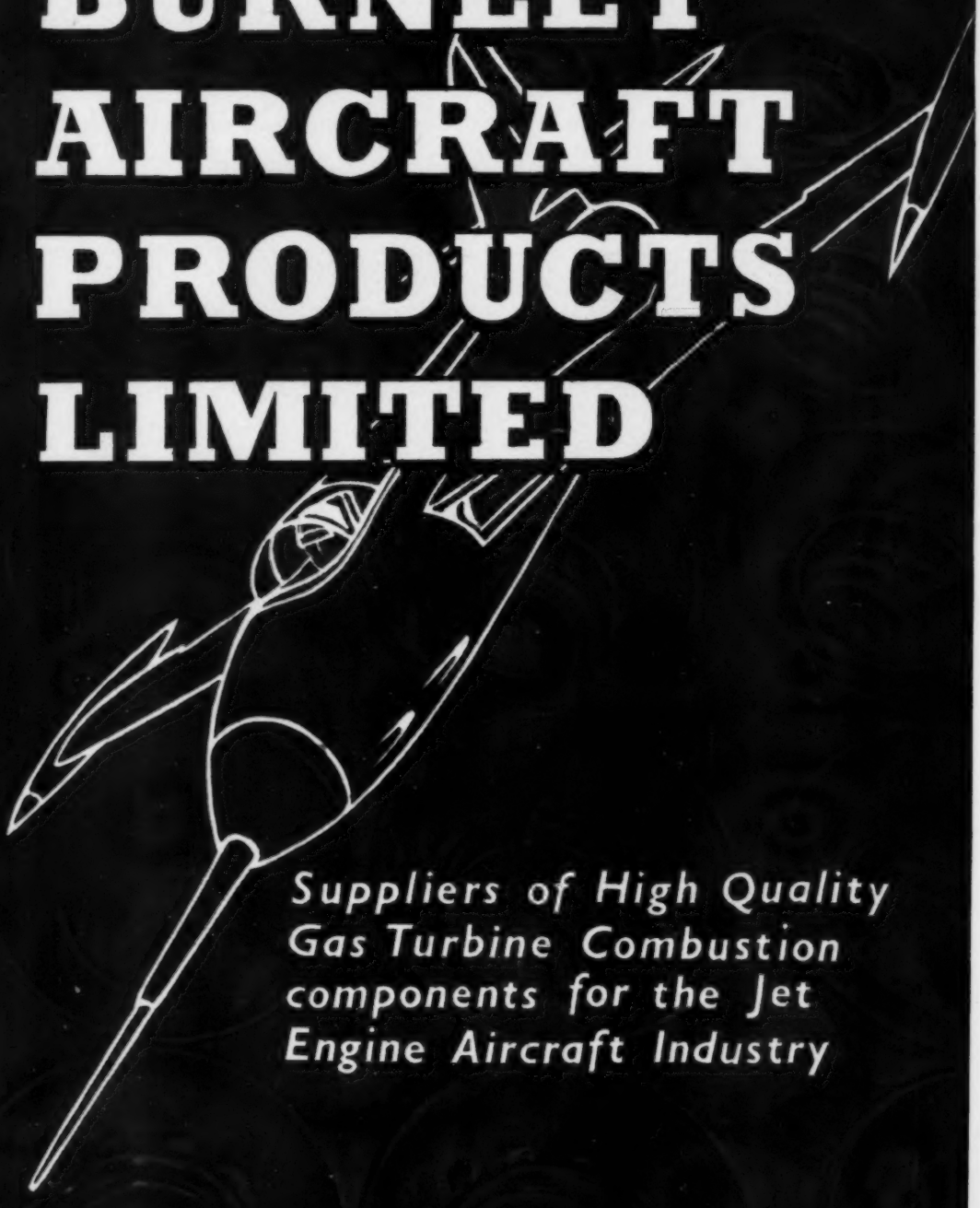

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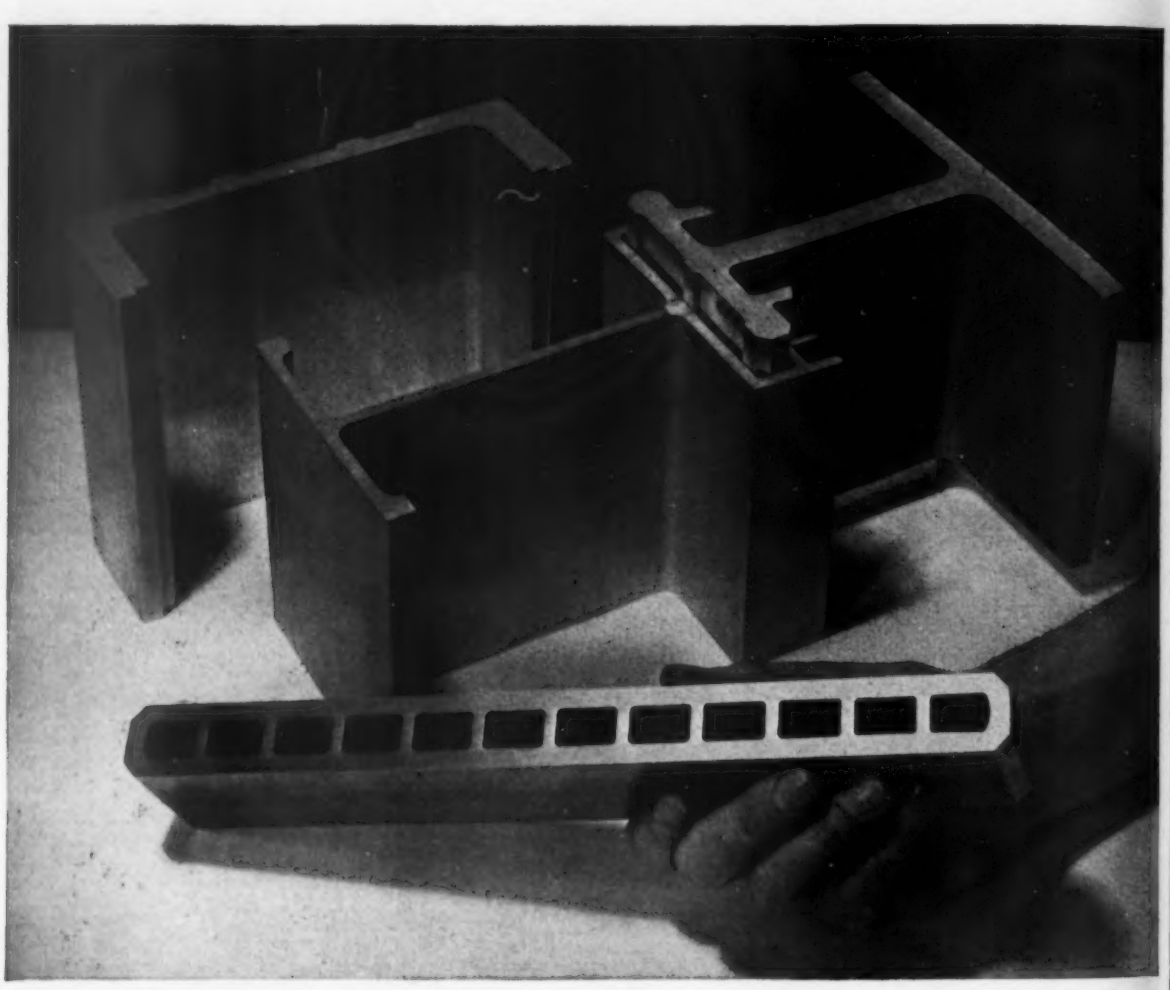

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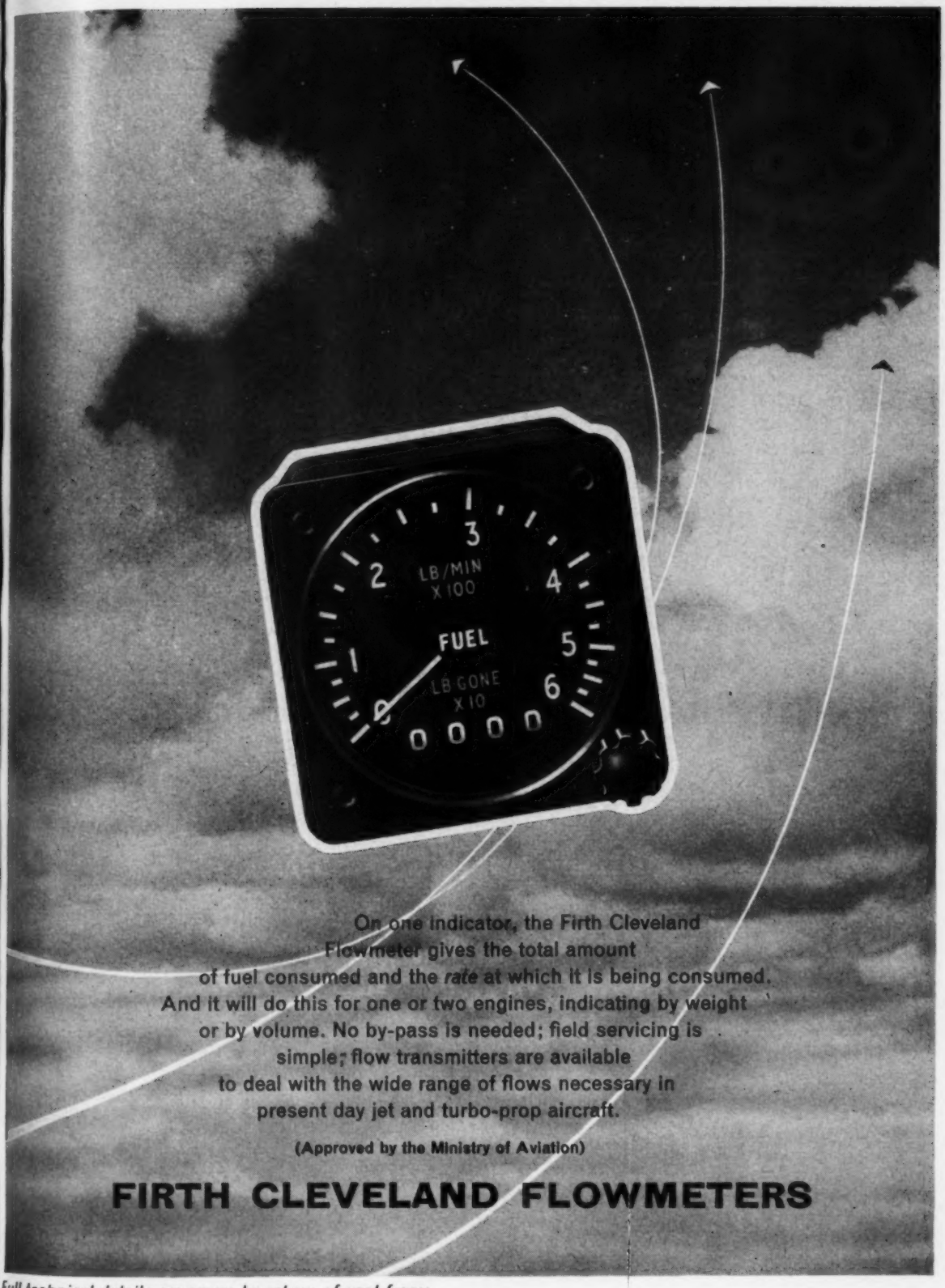

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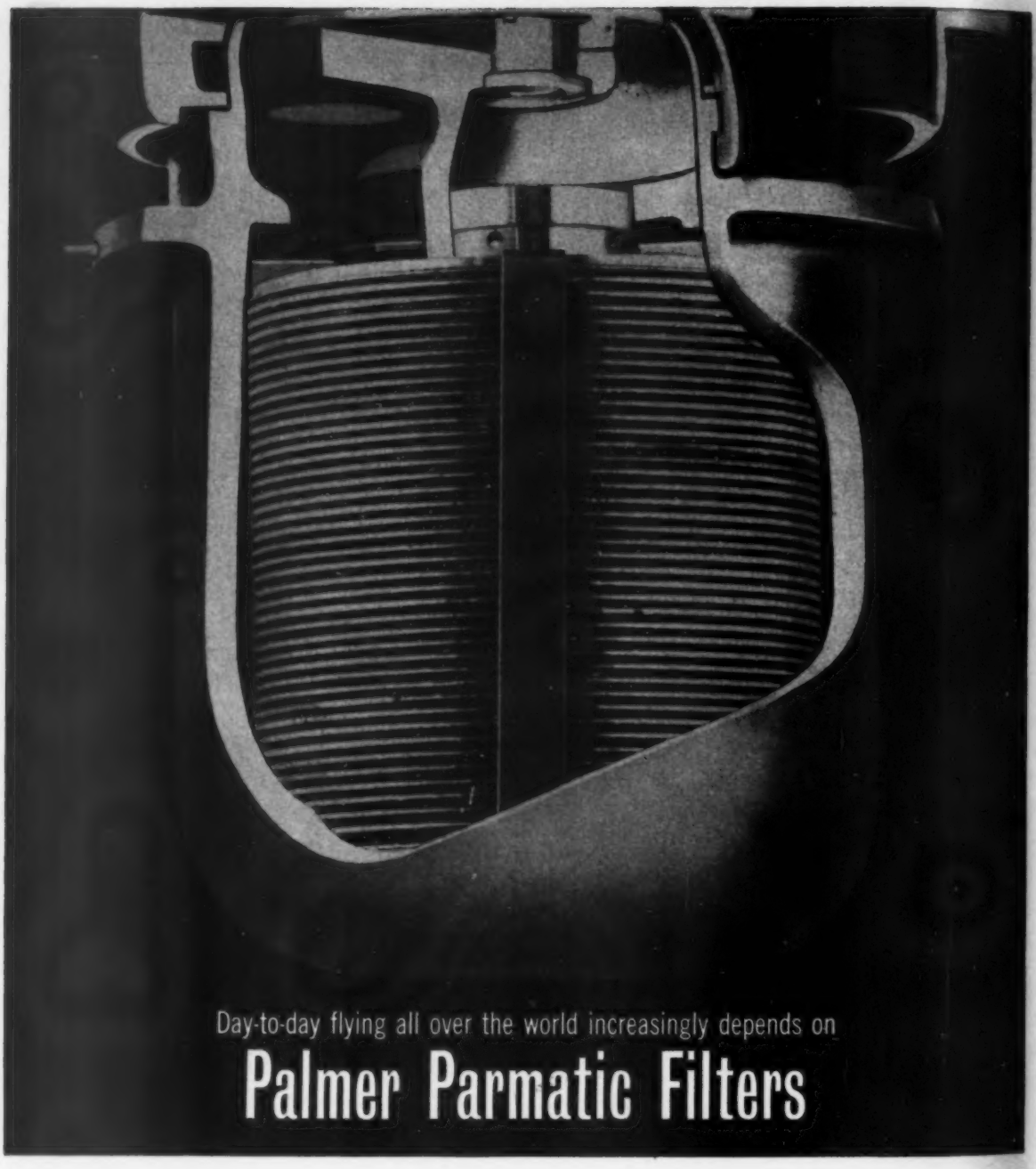

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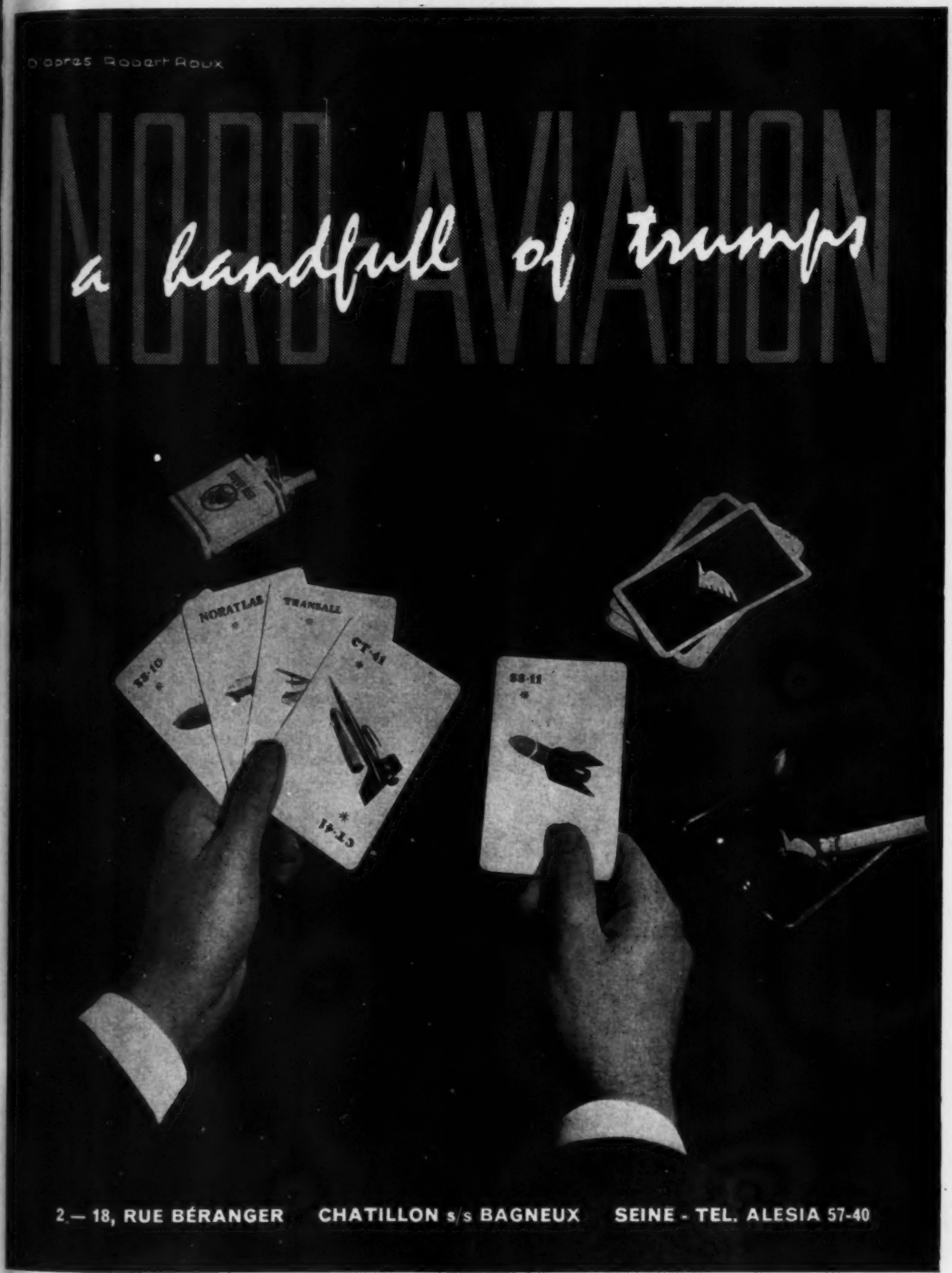
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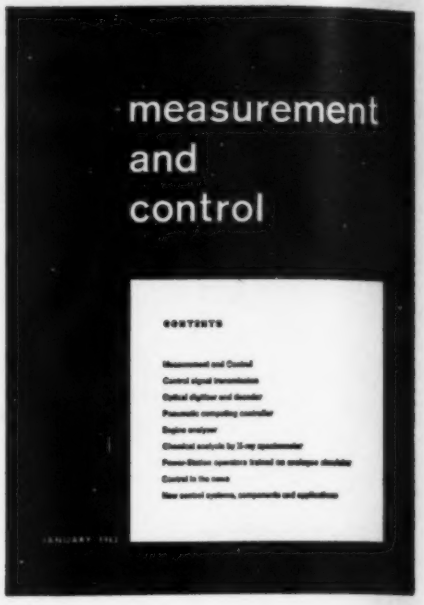

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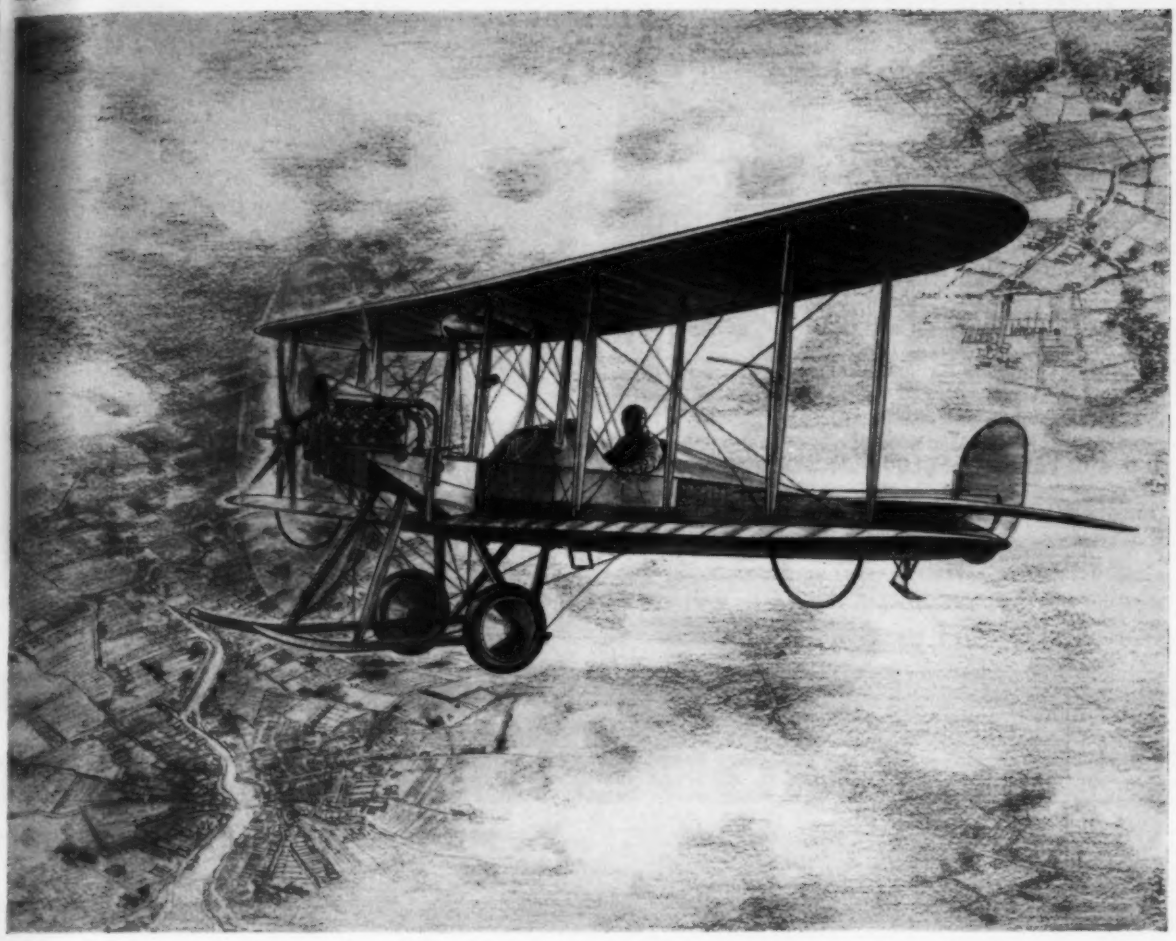

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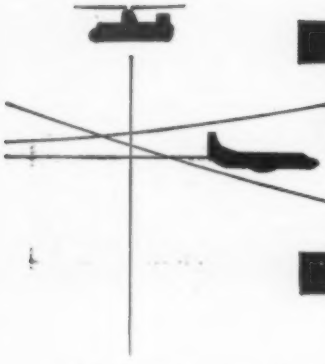

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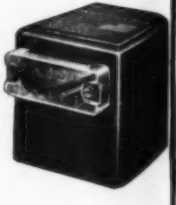

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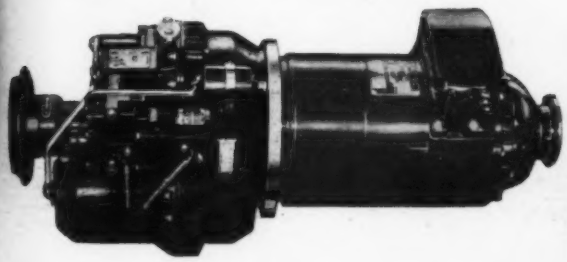

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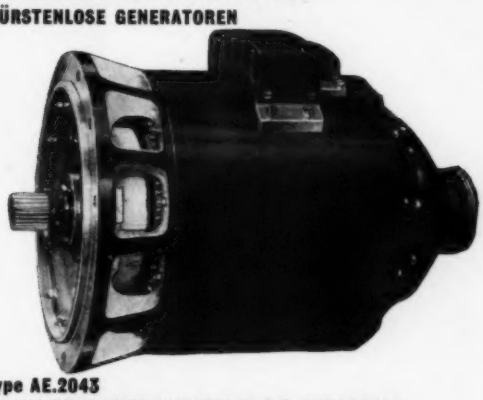

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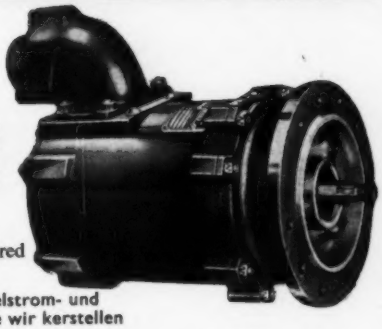

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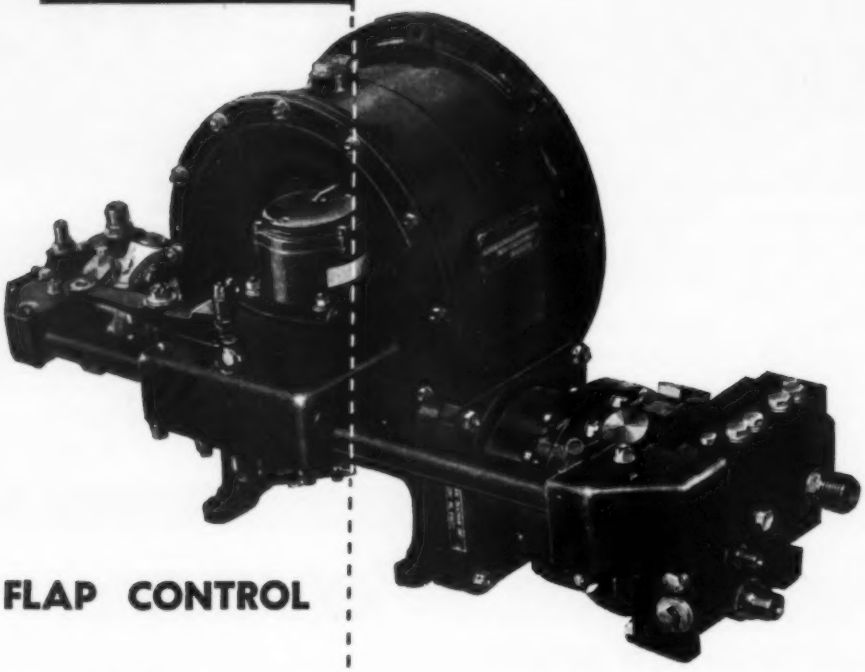

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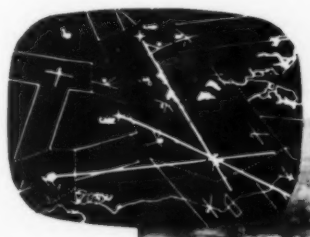

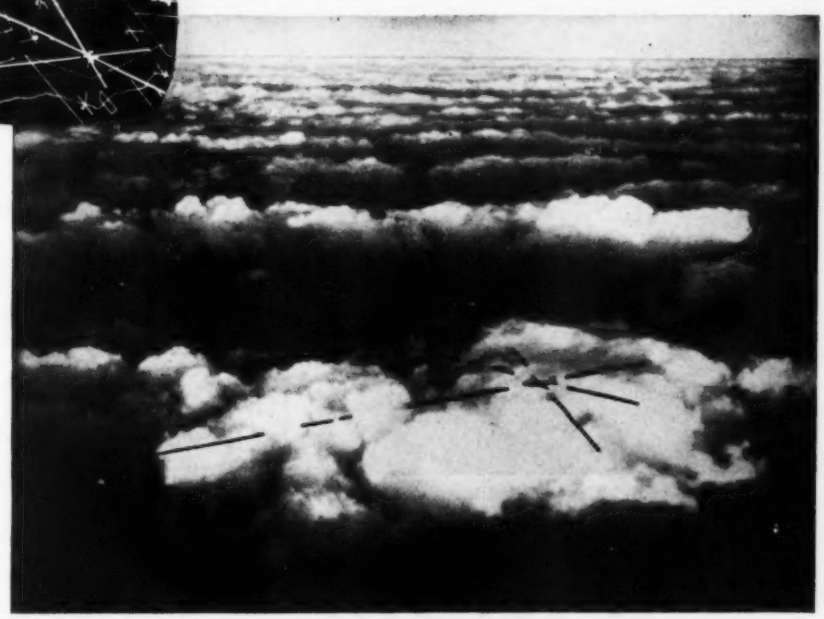

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Aces and Kings

THE story goes that the late Chico Marx, after a run of bad luck at poker, wrote to a firm of playing card manufacturers. "Gentlemen," he asked, "are you still manufacturing aces and kings?" In 1958, 1959 and 1960 airlines holding cards marked "707" or "DC-8" had a strong hold over the North Atlantic; but experience during the early summer of this year on this, the plummiest of plum routes, revealed the uncomfortable truth that quality competition was being played out to its utmost limits, notwithstanding the fact that BOAC, PanAm, TWA and Air France have all in recent months placed small repeat orders for big jets intended for this route.

It became clearly apparent during recent hearings before the Air Transport Licensing Board that a new definition of the word "competitive" was required; in particular, Mr Stephen Wheatcroft of BEA underlined the great paradox of modern air transport when he replied to a question about the desirability of more competition in Europe. Aircraft productivity in capacity ton-miles per hour had increased to such a degree, he said, that competition could now be less easily sustained. In other words, the more competitive one's equipment, the less competitive it is.

What do we really mean when we say that an airliner is competitive? Surely the real criterion is not merely the ability to attract traffic away from older jet or propeller-driven aircraft, valuable as that can be. Such an ability (as the North Atlantic operators must be ruefully reflecting) is essentially short-term and demands massive and frequent investment. What is needed is the ability to *generate* entirely new traffic rather than merely to take existing traffic from competitors, i.e., the ability to tap the mass travel markets by operating as cheaply as possible. This is a familiar argument, but its validity is enhanced, rather than diminished, by repetition. What is needed badly is a truly competitive airliner—one designed specifically to operate as cheaply as possible, thereby generating entirely new traffic; and if anyone doubts where the traffic is coming from, let him reflect that only about 10-15 per cent of the US population flew last year by US carriers. Who will be the first airline executive to sponsor the genuine "air bus"? A rich reward will surely await the firm that can give a satisfactory reply to a question of increasing urgency—"Gentlemen, are you still manufacturing competitive airliners?"

Guidebook

PUBLICATION next month of a *vade mecum* for private and executive pilots, under the title *General Aviation Flight Guide* (some details of which are given on page 605), is to be welcomed. Together with the relaxation of restrictions on the use of London Airport, announced earlier this year, the new manual marks a slight thaw in general aviation's winter of discontent. At least these moves imply that those responsible for civil aviation in the United Kingdom recognize the existence of private and business aircraft—a recognition that comes none too soon.

Flight has campaigned hard for a more compact and less legalistic reference book than the UK *Air Pilot* for private and business pilots, and much of what was advocated seems—from the advance information—to be contained in the *General Aviation Flight Guide*. It remains to be seen, when copies are released by HM Stationery Office, whether the format is as convenient and lightweight as has been suggested; and it is to be hoped that the contents are not merely a digest of the *Air Pilot*, but a fresh approach to general aviation's requirements.

FROM ALL QUARTERS

Spey Airborne

AVRO Vulcan B.1 XA902 flew from the Rolls-Royce Flight Test Establishment at Hucknall on October 12 with Spey engines installed in the two inboard positions. The company's chief test pilot, Jim Heyworth, reported favourably on the handling qualities of the new engine during two flights lasting a total of 4hr. It is probable that the next aircraft to fly with Speys will be a de Havilland Trident; similar engines are specified for the BAC One-Eleven, and a strengthened (and probably uprated) military version is under development for the Blackburn Buccaneer S.2.

MoA Parliamentary Secretary

ONE of the Government changes announced by the Prime Minister at the beginning of last week was the appointment of Mr C. M. Woodhouse as Parliamentary Secretary, Ministry of Aviation. He succeeds Mr Geoffrey Rippon, who has become Joint Parliamentary Secretary, Ministry of Housing and Local Government.

Mr Woodhouse is a specialist in international affairs. Before becoming an MP in 1959 he was director-general of the Royal Institute of International Affairs.

Mr C. M. Woodhouse

Whitworth Gloster Aircraft

IT was announced last week by Hawker Siddeley Aviation that the first phase of the merger between Sir W. G. Armstrong Whitworth Aircraft Ltd and the Gloster Aircraft Co Ltd (*Flight*, August 17) had been completed. Gloster Aircraft have ceased trading under that name and all business of the two companies is now being conducted under the name Whitworth Gloster Aircraft Ltd.

The Whitworth Gloster board is as follows: Sir Roy Dobson, Sir Thomas Sopwith, Messrs H. Burroughes (chairman), W. S. D. Lockwood (managing director), C. Bayly (general manager), J. T. Lidbury, S. D. Davies, F. Martin, E. D. Keen (chief engineer—aero), F. D. Stallabrass (secretary), E. W. Shambrook (financial director) and H. W. Sidwell.

Mr Burroughes was previously chairman of Gloster Aircraft Co; Mr Shambrook and Mr Sidwell were members of the Gloster board. Two former members of the Armstrong Whitworth board, Mr H. M. Woodhams (chairman and managing director) and Mr H. E. Watson (technical director) have retired.

Navy Demonstrates Automatic Ejection

LAST Monday afternoon at Stokes Bay Pier, near Lee-on-Solent, the Royal Navy—in association with Martin-Baker, Walter Kidde and R.F.D.—gave a demonstration of safety equipment to air attachés from Belgium, Canada, Denmark, France, West Germany, Holland, Italy, Norway, Sweden, South Africa and the USA. A dummy was ejected in a Martin-Baker rocket seat from a lighter. After rising to its maximum height of 350ft, the dummy descended by parachute into the water, the Mae West inflated and the Walter Kidde system automatically spread the dinghy and lifted the dummy clear of the water.

The object of the demonstration was to show that a man need do no more than pull the ejection blind; he can then be transferred safely into his dinghy even if he is unconscious or seriously injured.

Earlier, at HMS *Dolphin*, the RN Underwater Establishment, the Navy had demonstrated another safety device. This was a compressed air system attached to the starboard Martin-Baker gun to allow gentle ejection under water. In emergency, the normal cartridge would be used, but the new compressed air system would raise the man to the surface without the danger of flying clear of the water. Once again, the automatic dinghy would inflate to support him.

TEST RIG at Stratford, Conn, for the propulsion (two 4,050 s.h.p. Pratt & Whitney JFTD-12s), transmission and rotor system of the Sikorsky S-64 Skycrane. The same dynamic components are used in a projected assault transport, which would carry 18,000lb over short ranges

INITIAL HOVER PHASE of the Boeing-Vertol YHC-1B Chinook's flight-test programme was recently completed at Philadelphia International Airport at a loaded weight of 25,000lb (maximum is 33,000lb). On order for the US Army, the YHC-1B is powered by two Lycoming YT55-L5 shaft-turbines of 1,940 s.h.p. each

Fiat's F-104G Trainer

A MOCK-UP is being built in Turin for a version of the Fiat G.91T trainer fitted in the front cockpit with the instruments and radar of the F-104C. Fiat thus joins the group of companies tendering for the F-104G trainer contract. Hawker have proposed a version of the Hunter T.7 and Northrop are working hard to sell the T-38 Talon. Both would have the Nasarr radar, and cockpits closely resembling that of the F-104G. A major description of the F-104G and its production in the USA, Canada, Europe and Japan begins on page 622 of this issue.

Shoreham Development

BEAGLE (British Executive and General Aviation Ltd) have put forward proposals for developments at Shoreham Airport which are likely to be discussed by the planning standing sub-committee of Sussex County Council tomorrow (October 20). If they are accepted, and if the Minister of Housing and Local Government treats them as a matter of urgency, Governmental approval "should be forthcoming by the end of this month."

The proposals envisage new buildings—planned as an assembly hall—to be erected to the west of the present airport administrative buildings and hangars, with an eventual floor space of 202,000 sq ft, replacing some 100,000 sq ft of temporary buildings. Following a meeting between the planning committee of Worthing Rural District Council and representatives of the Beagle Group on September 28, a revised application by Beagle was being submitted to a planning committee meeting last Tuesday, prior to submission to tomorrow's county planning sub-committee meeting.

New Russian Records

THE photograph at the top of the facing page depicts the *Vertokrylo* (Rotorwing) designed by Nikolya Kamov, first seen at Tushino on July 9 (*Flight*, July 27). On October 7 the example shown (with fairings on the twin-wheel undercarriage) was flown over a 15/25km closed circuit at 366km/hr (227.4 m.p.h.), and details are being submitted to the FAI for confirmation as a world record. On October 12 the aircraft was flown over a 100km circuit at an average speed of 336km/hr (208.8 m.p.h.), which has also been submitted for ratification, beating the official figure of 307km/hr (190.7 m.p.h.) by the Westland Rotodyne.

On both flights the Kamov was flown by the following crew: Dmitriy Yefremov, first pilot; Vladislaw Gromov, second pilot; Mikhail Savelyev, navigator; Viktor Alperovich, first engineer;

A NEW RECORD for aircraft of its class—227.4 m.p.h.—is claimed for this Russian Kamov convertiplane, powered by two turboprops, each of 5,622 h.p. This power is greater than had been supposed in the West, and even exceeds that of the Mi-6. (See news-item)

Yevgeniy Filatov, second engineer; Vladimir Bator, flight electrician. Both the measured courses were flown at an altitude of 3,000m (9,840ft), and it is reported that the maximum speed reached on the 100km course was 375km/hr (233 m.p.h.). The power of each engine was given as 5,700 metric h.p. (5,622 h.p.), which is 1,000 h.p. greater than the output of the TB-2BM engines of the giant Mi-6.

On October 7 it was reported from Moscow that A. Fedotov, flying an "E-166 jet aircraft," had flown a 100km closed circuit at a mean speed of 2,385km/hr (1,481.9 m.p.h.), and that this has been submitted to the FAI for ratification as a world record. At some stages of the flight his speed is said to have been 2,730km/hr (1,696.3 m.p.h.). Three days previously, *Tass* reported that the FAI had informed the Chkalov Central Aeronautical Club that it had endorsed as a world record the altitude of 34,714m (113,892ft) reached on April 28 last by Georgiy Mosalov, flying an E-66A.

Shorts' Managing Directors

Mr H. G. Conway (left) and Mr R. E. Harvey, now appointed joint managing directors of Short Brothers & Harland Ltd; they have been joint deputy managing directors since October 1957. Mr Conway joined as chief engineer in 1954, becoming a director a year later; Mr Harvey joined as chief production engineer in 1943 and has been a director since 1953. The chairman, whose appointment was announced last May, is Mr C. E. Wrangham

General-aviation Guidance

A NEW publication for private and executive pilots, "intended primarily to provide generally useful data for flight in VMC outside controlled airspace," will appear at the beginning of next month.* Known as the *General Aviation Flight Guide*, it supersedes the CAP 111 *Radio Facility Charts*, and contains some of the information already in the UK *Air Pilot*; but it is not intended as a replacement for the latter.

In the Sport and Business Flying special issue of *Flight* for March 25 last year, the need for such a guide was strongly urged. The Australian *Private Pilots' Handbook* was quoted as a good example, and suggestions for what a British manual should contain included (*a*) information on actions in emergency, or in "any state of uncertainty"; (*b*) radio maps and charts; (*c*) altimeter setting procedures; and (*d*) a table of aerodrome, light, pyrotechnic and other symbols.

The *General Aviation Flight Guide* initially includes information under the following headings: aerodromes; communications; meterology; air traffic rules and services; search and rescue; and aeronautical charts. Its UK *Air Pilot* pages are issued in flexible plastic loose-leaf fold-back covers for ease of reference during flight. The guide will be kept up to date by monthly supplements of reprinted pages.

* *Obtainable from H.M. Stationery Office, York House, Kingsway, London, WC2, price £1 2s 6d (£1 3s 9d by post), from HMSO branches, or through booksellers.*

IN BRIEF

Capt P. J. Hill-Norton, who for the past two years has commanded the aircraft carrier HMS *Ark Royal*, is to be Assistant Chief of Naval Staff from January next year with the rank of rear admiral.

Miss Jacqueline Cochran exceeded her own record for a 100km (62-mile) closed circuit on October 6, when she flew a Northrop T-38 Talon at 784.337 m.p.h. Her record was set up in 1953, when she flew an Orenda-engined F-86E Sabre at 1,050.182km/hr (about 653 m.p.h.).

About 250 bombers, including 15 V-bombers from RAF Bomber Command, took part in the NORAD defence exercise, *Sky Shield II*, last weekend (see Service Aviation, page 635). All civil aircraft were grounded during the exercise, in which 1,800 jet fighters participated.

The Guild of Air Pilots and Air Navigators have invited nominations for the award of the Guild's trophies and medal for the year 1960-61. Awards are the Johnston Memorial Trophy, Cumberbatch Trophy and Brackley Memorial Trophy; the medal is the Derry and Richards Memorial Medal. Nominations, complete with supporting details, should reach the Guild's office at 14 South Street, Park Lane, London W1, not later than December 8.

Republic Aviation Corporation reported recently that more than 60 F-105s had been ferried nonstop across the Atlantic in the past four months from Mobile Air Materiel Area, Mobile, Ala, to the USAF base at Bitburg, Germany. The flights, involving an elapsed time of 9-10hr, were made with four air-to-air refuellings.

Winner of the aircraft recognition competition organized by Macdonald & Co (Publishers) Ltd to commemorate the 21st anniversary of the Battle of Britain was Mr Anthony Spicer of Cardiff. Competitors were asked to identify British and Italian fighters of the Second World War from parts of photographs cut out to form the words Macdonald Books. Reference could be made to *War Planes of the Second World War: Fighters*, by William Green, who was one of the judges.

The issue and volume numbers at the head of the title page of last week's issue were wrongly quoted, owing to a typographical error: they should have read: No 2744, Volume 80.

Tomorrow's (October 20) issue of our associated journal *The Autocar* will be a greatly enlarged London Show Report number, price 2s 6d. Next week, the London Show Review number is being published, at the usual price of 1s.

PHOTOGENIC FORTRESS: One of the three B-17s flown to Gatwick from Arizona for the film of John Hersey's novel "The War Lover." Capt John Crewdson (managing director of Film Aviation Services Ltd), pilot of the leading aircraft, is seen disembarking after the ferry flight

ARGOSIES AT WORK

Riddle Airlines' AW650s Are Operating At A Rate Of 4,416hr A Year

BY THE AIR TRANSPORT EDITOR

ALTHOUGH Miami International Airport is only rarely frequented by Riddle Airlines' Armstrong Whitworth Argosies, it is there that the company has its headquarters and main commercial operating base. On a recent visit to that part of the world by Cunard Eagle Britannia (which operates the one and only one-aircraft service between London and Miami), I spent two or three hours with Riddle's vice-president, military operations, Mr Howard R. Donalson. We hope in a subsequent issue to publish a first-hand account of the Argosy at work on USAF "Logair" services operated (at the remarkable rate of 4,416hr per aircraft per year, or 12hr per day) on behalf of the USAF Logistics Command. But first it is appropriate to look behind the scenes of what is without doubt the most advanced and intensive air freight operation in the world.

I quickly formed the impression that Riddle's success as an all-cargo line is the result of really enlightened thinking, planning and management. This is a sweeping statement after only a brief acquaintance; but the direct, positive way in which my questions were answered unbriefed, and the supporting documentation that was produced by Mr Donalson and his colleagues, was for me evidence that Riddle is an airline with an unusually progressive approach to business.

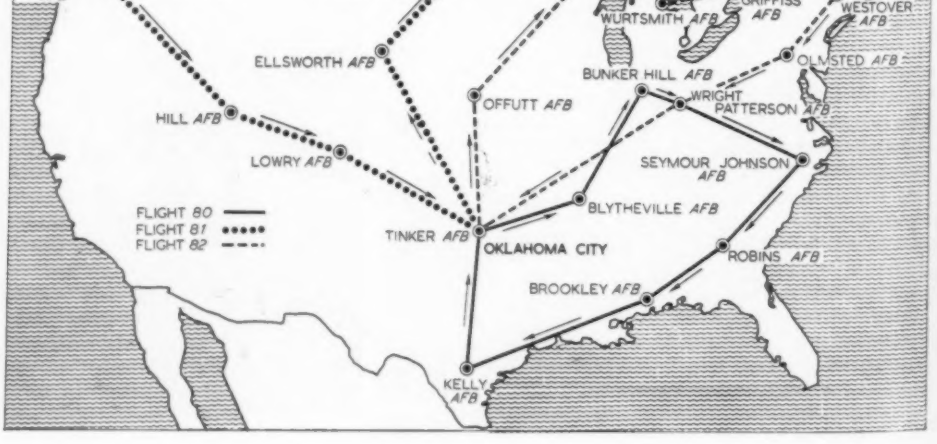
First, and briefly, let us look at the background to the airline as a whole. Riddle do six distinct kinds of business. At the moment 40 per cent ($15m) of the airline's total revenue comes from DC-7CF cargo and passenger operations—mostly international—carried out for MATS. Last month, for instance, 54 DC-7CF flights were operated between the USA and Europe; this month most of the work is on the Pacific. Next in importance, in terms of revenue (about 35 per cent, or $13m), is the "Logair" work done by Argosies and C-46s. Logair is a scheduled cargo airlift service operated on behalf of the USAF by five civil carriers; Riddle, Aaxico, Capitol, World Airways and Zantop. Logair services supply 89 USAF stations in the USA with equipment and stores seven days a week, 24hr a day. It is the biggest cargo airlift in the world.

In addition to these two kinds of military work, which account for approximately 75 per cent ($28m) of the airline's revenue, Riddle operate: (3) an extensive network of scheduled commercial air freight, mail and charter services within the USA and Puerto Rico; (4) world-wide cargo charters; (5) transatlantic passenger group charters, all with DC-7CFs; and (6) fixed-contract operations with individual corporations.

The airline operates a fleet of ten DC-7CFs, each with a 40,300lb payload, all being converted passenger aircraft acquired from Northwest and SAS. There are 29 C-46s hard at work on both military and commercial routes, 15 being applied exclusively to Logair (operating, incidentally, with 99 per cent regularity and punctuality). Two more C-46s may soon be assigned to Logair operations. There is also one DC-4, which may soon be disposed of, and the seven Argosies, all of which are assigned to the Logair routes depicted in the map.

So much for the broad background to the airline which, for the first time in its history, is hoping to make a profit in the current financial year (July 1961 to June 1962). The budgeted net profit is about $5,000 on an operating revenue budgeted at some $38,000 —three times the revenue achieved three or four years ago.

So much for the background to the airline itself. The first Argosy was delivered by Armstrong Whitworth to Riddle on December 8, 1960, and made its first revenue flight on Logair work on January 15, 1961. (This was, for the record, the first revenue operation ever to be made by an all-cargo turboprop aircraft.) Full scheduled services began on the morning of January 16, 1961. Unfortunately, ten days later the aircraft were grounded, due to skin cracking discovered in the vertical and horizontal tail surfaces. The ensuing modification programme is a story yet to be told in full; but in the words of Mr Donalson, Armstrong Whitworth "pulled all the stops out, very definitely, to complete the modifica-



This "Flight" map shows the 12,300-mile route structure serving 27 US Air Force bases operated each day by Riddle Argosies on Logair contract to the USAF. Three separate flights are operated daily, as shown

Here a complete Argosy load is seen about to be embarked at Tinker AFB, Oklahoma. Loads are all on pallets and the 40ft trailers are "rollerized"

tion programme as quickly as possible." At the time of writing, with all seven Argosies delivered, five are fully modified and cleared and two are expected to obtain FAA clearance shortly.

During the first month of July 1961, which is the first month of Riddle's 1961-62 financial year, five Argosies operated 96.7 per cent of the scheduled Logair mileage, and this was achieved with no spare aircraft. During the second month a regularity of 97.45 per cent was achieved, and the figures for September and October are higher still.

Utilization since July 1 has been at a rate of 4,416hr per year—368hr per aircraft per month. When I registered the surprise I have always felt at the magnitude of this figure, particularly for a new aircraft, Mr Donalson remarked: "It isn't remarkable if you are going to make money in this business." He pointed out that Riddle's C-46s, which are "old enough to vote," are regularly running at a rate of 260-300hr a month (up to 3,600hr each per year); and that each of the airline's ten DC-7CFs are approaching an annual utilization of 4,400hr per year.

The map on the previous page shows the Logair route pattern, three flights a day operated by the Argosies. Operations go on round the clock, each aircraft spending 22hr once every third day on the ground at Oklahoma City (Tinker Air Force Base) for maintenance. This is of the progressive type, initial block check time being 2,000hr.

I asked for a measure of the punctuality record achieved by the Argosy. The months of July and August were "acceptable but not good," I was told, the respective figures being 42 per cent and 60 per cent. The US Air Force requires a punctuality rate of 75 per cent at least, with 90 per cent desirable, and the comprehensive Logair manual issued by the USAF to contractors includes a "performance reliability computation." If a contractor falls down on any aspect of his required performance, including punctuality, the USAF will require the contractor to pay the bill for sub-contractors who may be called in; in extreme cases, the contract may be broken off. However, the USAF did not penalize Riddle for the less-than-acceptable punctuality record of July and August; the USAF is on a learning curve too, and many of the delays were attributable to loading and unloading, which the USAF handles itself. Between the 15th and 20th of every month Riddle receives from the USAF a report on its results for the previous month, and the Argosy punctuality record for September was approaching the desired 75 per cent. According to Mr Donalson, the record so far in October has been "darned near perfect."

When will Riddle put Argosies on to their commercial cargo services? This will certainly happen, in what is described as the "foreseeable future," but Riddle cannot say precisely when. The future of the aircraft on what they call "SAF"—common carriage scheduled freight services—could be dependent on the delivery of further Argosies.

But the company has done a great deal of work on estimating the operating cost of the Argosy on commercial cargo services. I was shown a cost comparison between the C-46 and the Argosy, setting out in detail the cost of every movement of a load from the off-loading to the on-loading of the delivery truck. In the case of the C-46 more than 30 stages are required, this being cut by about a half by the Argosy. Assuming an average load (75 per cent load factor) of 9,365lb for the C-46, and 20,250lb for the Argosy, the relative cargo handling cost per 100lb works out at $0.2565 for the C-46 and $0.1022 for the Argosy—a reduction of 250 per cent.

Copying down these figures, in Mr Donalson's office, I rounded them off to $0.25 and $0.10. "You should put in the decimals," he remarked, "because half a cent can cost us thousands of dollars."

In addition to its seven new Argosies, Riddle operates ten DC-7CFs and 29 C-46s on military and commercial work. These two "Flight" pictures were taken last week at the airline's new cargo area at Miami

The main features of the Argosy are captured in this picture, which shows the double-end loading, unobstructed freight hold at truck bed height, conveyor loading system, and full width doors

Missiles and Spaceflight

Washington Congress

From KENNETH OWEN **Part 2: FINAL DAYS AT THE INTERNATIONAL ASTRONAUTICAL FEDERATION MEETING**

THE activities of the parent International Astronautical Federation and its twin offspring the International Academy of Astronautics and the International Institute of Space Law became intermingled during the final days of the twelfth IAF Congress in Washington. At the congress banquet on Thursday, October 5, the Academy's first Guggenheim Award was received on behalf of Prof Sir Bernard Lovell of Manchester University by Dr Harry Hookway, chief of the British Scientific Mission in Washington.

Dr Hookway read an acceptance message from Sir Bernard which said, in part:—

"I feel very greatly privileged to be the first recipient of this award, and I am most conscious of the fact that I am merely the avenue through which the International Academy of Astronautics has honoured the team of young scientists at Jodrell Bank, and through which it has paid tribute to the radio telescope which we are fortunate enough to possess . . . The first use of the telescope in early October 1957 was to track the first Sputnik and its carrier rocket by radar, under conditions of extreme difficulty before the engineers had completed their final tasks.

"Our most memorable success occurred with Pioneer 5. Twenty minutes after its successful launching from Cape Canaveral on March 11, 1960, a signal transmitted from the telescope released the space probe from its final carrier rocket. Then, every day for four months, a signal from the telescope switched on the transmitter in the probe to enable us to record the information which the instruments in the probe were collecting on the conditions in interplanetary space. In this way Pioneer 5 was tracked to a distance of over 22m miles from Earth before the power supplies in the probe failed.

"The Jodrell Bank telescope has been truly an international instrument during these years because our co-operation has embraced the space activities of the Soviet Union as well as those of the United States. For example, the recordings made of the approach of Lunik 2 to the Moon and the measurement of the Doppler shaft, which enabled us to calculate the acceleration of the rocket towards the lunar surface and the approximate point of impact, probably represents one of the most significant measurements so far made with the telescope.

"Now, in the United States at least, deep space tracking facilities specifically tailor-made to the new series of space probes are in operation. Nevertheless, whenever the special facilities of what is still today the world's largest steerable radio telescope are needed, then our scientific colleagues whether they be American or Russian can be assured of the ready and willing co-operation of Jodrell Bank. . . ."

Other awards presented at the banquet included three by the Space Law Institute—a gold medal to Prof John Cobb Cooper and cash awards to Michael S. Smirnoff of Yugoslavia and to Vladimir Kopal of Czechoslovakia. Prof Samuel Herrick, chairman of the congress committee, reported that some 750 delegates had registered for the meeting, of whom about 300 were from abroad.

Titov's Reactions

During the previous day's technical sessions Gazenko and Yazdovsky of the Soviet Union had amplified the earlier mentions made in Moscow of "unpleasant sensations" experienced by Maj Titov during his August 6 orbital flight. In their paper *Some Results of Physiological Reactions to Space Flight Conditions* they reported:—

"As a thoughtful, keen observer, Titov noted some important symptoms. In conditions of weightlessness unpleasant sensations of the vestibular character were felt stronger and stronger, especially when the astronaut sharply turned his head or was observing swiftly moving objects. After some period after sleep these phenomena decreased, but did not disappear before the beginning of the action of overloads during the ship's recovery to earth. Thus, the sensation of some discomfort accompanied the considerable portion of the flight and resembled sea-sickness.

"H. Titov's observations have attracted great attention. They require careful analysis and undoubtedly will serve as an initial point for special investigations in this direction . . ."

Details of the US Navy's new 600ft radio telescope were given in two papers by Edward F. McClain and James H. Trexler of the US Naval Research Laboratory during one of the sessions devoted to the exploration of the solar system by radar and radio astronomy. Dr John Thomson of Jodrell Bank was unable to be present to talk on the radar study of Venus but, on the subject of the Moon, the implications of new theoretical studies on the lunar surface were described by Prof Zdenek Kopal of the Department of Astronomy, Manchester University.

The final technical sessions of the congress were held on Friday, October 6, when G. K. C. Pardoe of de Havilland Aircraft not only gave his own paper *Blue Streak as First Stage of a Satellite Launcher*, but also deputized for Dr L. R. Shepherd, who was to have spoken for the United Kingdom in a session devoted to "Recent Results and Plans in International Astronautics." Mr Pardoe concentrated on "plans" by telling us more about Blue Streak.

At the same session on national results and plans, Dr Hugh L. Dryden of the National Aeronautics and Space Administration gave a comprehensive review of his agency's overall programme and international activities. He said that the next major step in Project Mercury would be a three-orbit flight in which a chimpanzee would be carried in the spacecraft. If this were successful, it might be followed by a manned orbital flight. The speaker still hoped that this would take place before the end of this year. NASA's international programmes, Dr Dryden indicated, included agreements for joint satellites with Britain and Canada; and arrangements for co-operative sounding-rocket programmes with Argentina, Australia, Canada, France, Italy, Japan, Norway, Pakistan and Sweden.

Academician Leonid Sedov of the Soviet Union declined to present any contribution from his country at this session, although this had been included on the printed programme.

Mercury Safeguards

The problems of combining the technologies of manned aircraft and of missiles in the Mercury programme were described in *The Manned Rocket Vehicle Mercury-Redstone* by Dr J. P. Kuettner of Marshall Space Flight Center and E. P. Bertram of the NASA Launch Operations Directorate at Cape Canaveral. These two philosophies had developed along entirely different lines, the authors pointed out, and had come together for the first time in Project Mercury, where one had literally a man-carrying (or "man-rated") missile.

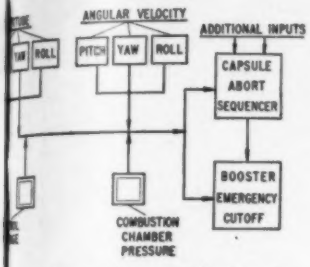
The automatic escape system of the Mercury (see diagram opposite) was designed to anticipate cases of suddenly developing catastrophic failures and used a restricted number of partly redundant sensors. There were able to detect a great variety of malfunctions, because many of them resulted in the same sequence of events; but, according to the authors, there was room for improvement.

The reliability requirements of the man-carrying missile concerned both mission reliability and survival reliability. The latter obviously depended on the reliability of the escape system in case of mission failure, which included short-sensing, ejection and recovery. A mission reliability of 85 per cent combined with an escape reliability of 85 per cent resulted in a survival reliability of about 98 per cent, which seemed reasonable.

On the operations side, time studies were made (see diagram) prior to selecting equipment to ensure maximum safety for the astronaut during the countdown period on the pad. The pad rescue team used an armoured personnel carrier and operated a mobile tower or "cherry-picker." The total Mercury-Redstone launch countdown time was 10hr 40min, divided into 6hr 30min on the first day, a break of 15hr to give the ground crew a rest, and a 6hr 30min final countdown on the second day. The astronaut entered the spacecraft approximately two hours before lift-off, and the cherry-picker stood by on the pad throughout the final 55min of the countdown.

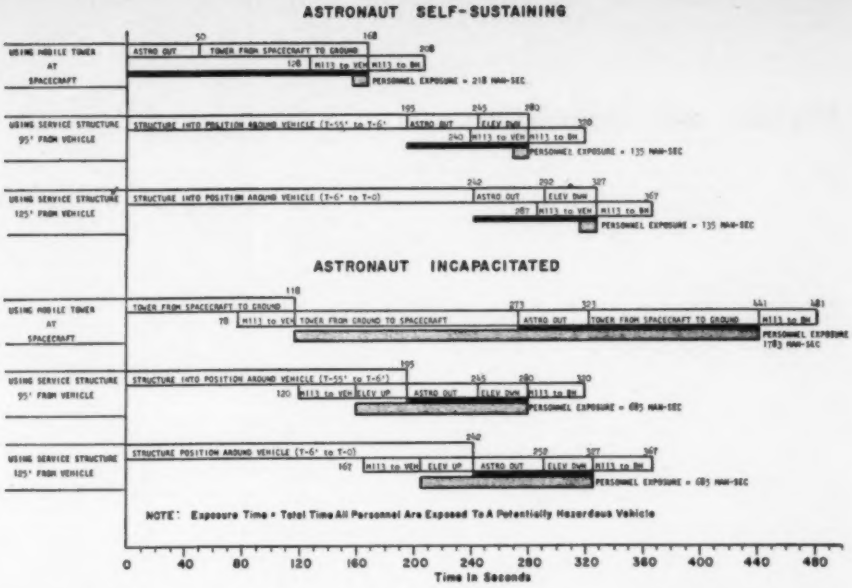
Intriguing new techniques in communication were discussed at a five-paper session comprising *COLIDAR, a light Radar* by George F. Smith of Hughes Research Laboratories: *ULTRACOM; Ultra-violet Communications* by J. W. Ogland of Westinghouse Electric Corp; *Gamma Ray Communications* by Jozef W. Eerkens of Aerospace Corp; *Measurement of Very-low Frequency Propagation by Lofti I Satellite* by J. P. C. Leiphart of the US Naval Research Laboratory; and *Light Communications* by J. P. Gordon of Bell Telephone Laboratories.

In the paper by Eerkens the gamma rays envisaged for communication are those produced as a by-product in the nuclear reactors which, in the author's view, are a near-certainty for future spacecraft propulsion and auxiliary power. Using a 100MW (thermal) reactor, it was estimated that morse-code transmissions could be



Above, Mercury abort-sensor system (Kuettner and Bertram)

Right, time-study for Mercury safeguards during countdown (from the same paper)


ASTRONAUT SELF-SUSTAINING
USING MOBILE TOWER AT SPACECRAFT
ASTRO OUT
TOWER FROM SPACECRAFT TO GROUND
M113 to VEH
M113 to BH
PERSONNEL EXPOSURE = 218 MAN-SEC
USING SERVICE STRUCTURE 95' FROM VEHICLE
STRUCTURE INTO POSITION AROUND VEHICLE (T-55' to T-6')
ELEV DWN
PERSONNEL EXPOSURE = 135 MAN-SEC
USING SERVICE STRUCTURE 125' FROM VEHICLE
STRUCTURE INTO POSITION AROUND VEHICLE (T-6' to T-0)
ASTRONAUT INCAPACITATED
TOWER FROM GROUND TO SPACECRAFT
PERSONNEL EXPOSURE = 1783 MAN-SEC
ELEV UP
PERSONNEL EXPOSURE = 685 MAN-SEC
NOTE: Exposure Time = Total Time All Personnel Are Exposed To A Potentially Hazardous Vehicle
0 40 80 120 160 200 240 280 320 360 400 440 480
Time In Seconds

made over distances of about 100,000 miles, and voice transmissions over approximately 1 000 miles. Because such radiation is heavily scattered and absorbed in the Earth's atmosphere, such communications would be limited to outer space, e.g. between satellites.

Papers presented in a structures session on the same day included reviews of Saturn S-4 structural design, of composite construction, of crack propagation and of material problems in space, contributed respectively by L. H. Abraham of Douglas Aircraft; Bryan R. Noton of the Swedish Aeronautical Research Institute; Prof A. J. Murphy of the College of Aeronautics, Cranfield; and L. D. Jaffe and J. B. Rittenhouse of Jet Propulsion Laboratory.

Investigations of cosmic radiation as measured by the second and third Soviet "spaceship satellites" (launched on August 19, 1960, and December 1, 1960) were reported in the paper *On Investigation of Cosmic Radiation on Spaceship-Satellites* by S. N. Vernov, V. E. Nesterov, N. F. Pisarenko, I. A. Savenko and P. I. Shavrin. The results of the experiments, the authors stated, made it possible to investigate in detail the boundaries of the Earth's radiation belts, to determine the planetary distribution of cosmic radiation, to reveal anomalies of cosmic radiation and to establish the distribution and quantities of the absorbed doses at the altitudes of the flights of spaceships 2 and 3.

Other Soviet papers included *Some Results of the Constant Geomagnetic Field Measurements carried out from Sputnik 3 over the Territory of the USSR* by S. Dolginov, L. N. Zhuzgov, N. V. Pushkov, L. O. Pyurmina, and I. V. Fryazinov; and *Investigation of Interplanetary Plasma and Planetary Ionospheres by means of Charged Particle Traps on Space Rockets* by K. I. Gringauz.

The Congress Ends

The Congress concluded on Saturday, October 7, with visits to NASA's Goddard Space Flight Center, a Western-style barbecue on the campus of Maryland University, and the Maryland-Syracuse university football game. Delegates were in turn impressed, overloaded and amazed.

Meanwhile, on a quick trip to Cape Canaveral, Dr L. R. Shepherd and Mr Len Carter of the British Interplanetary Society were handing over a silver plaque which the Society had awarded to the seven Project Mercury astronauts. This was received on behalf of the group by astronauts Shepard, Grissom and Cooper.

From Washington, most of the congress delegates were moving on to New York City and the annual meeting of the American Rocket Society, to be reported in these pages next week.

The guest speaker at the luncheon meeting on Tuesday, October 10, was Dr James Van Allen, head of the Physics Department at the State University of Iowa. On this occasion he was the recipient of the first American Rocket Society Research Award, donated by the Douglas Aircraft Co, for "his early application of rocketry to cosmic-ray research, his discovery of the radiation belts, and his continuing basic research in the field of space physics."

After receiving the award Dr Van Allen spoke on the subject of space science and the US universities. He said, in part:—

"The idealized role of the universities is to put the fine cutting edge on the massive and relatively blunt intellectual tools which we are using. This can be done in two ways. First, we must rapidly assume the responsibility for converting the callow and more-or-less half-baked interest and enthusiasm of our youth to solid competence. This is not an easy matter. . .

"The education of young people is one of the most elusive of human enterprises. Yet, by and large, colleges and universities have brought our culture to where it is today, and no other segment of our culture has yet demonstrated a comparable level of capability in transforming the interest and enthusiasm of youth into broad-gauge leadership. We believe that we can continue to do so in the space-science field, though we do not promise overnight miracles. And we will need substantial federal assistance if we are to match the national ambitions in this new field of human endeavour.

"Secondly, I believe that the graduate colleges of our universities have the potential for contributing in an essential, direct and far-sighted way to fundamental advances in space science and, perhaps to a lesser extent, in space technology . . ."

Although speaking in the context of the United States scene, the basic philosophy behind Dr Van Allen's remarks applies equally well to this country. Another speaker during Tuesday's activities at the meeting delivered a paper which was international in its implications—and, indeed, in its title. The author was Mr Arnold Frutkin, Director of International Programs, National Aeronautics and Space Administration, and his subject was *The Character of International Co-operation in Space*.

Mr Frutkin gave a realistic appraisal of the world space-science scene, and endeavoured to separate scientific and political implications—which in his opinion had frequently been indiscriminately intermixed. He said, in part:—

"International co-operation, particularly in science, is today looked upon much as an all-powerful and benign genie which is reluctant to come all the way out of the bottle. The feeling is widespread that if we only knew the right words to say, the genie would emerge and exercise his full powers to resolve many of the problems that vex the world . . .

"There are important misconceptions as to the amount and value of the work already done by the genie and the environment he requires for his best work. It is widely thought that the great precedent of international co-operation in geophysics is applicable in many other scientific and non-scientific fields. It is felt that there is a special quality in science which reduces political obstacles. This has led, in turn, to the hope that political problems might be solved if referred to scientific forums, or, on the other hand, that the introduction of scientific or technical programmes into political forums may have an ameliorating influence. There are undoubtedly elements both of truth and optimism in all of this . . .

"In our own field and in others as well, the prime illustration of the vast potential of international co-operation is the recent International Geophysical Year.

"There is a popular notion that the IGY represented a unified and integrated programme of inter-governmental co-operation in the study of Earth and its environment. In fact, the IGY was international principally in its non-governmental aspects. The international functions (planning and loose co-ordination) were performed entirely by committees of scientists representing only scientific institutions, reaching decisions only where unanimity could be achieved, and with little authority to implement their programmes. The implementation of their proposed programmes was done on a *national* basis . . .

"The reasons for its success tend to be rather special. In the first place, the problems of geophysics—unlike those in many laboratory sciences—actually require study of the earth on a global basis. Prior to the IGY, a long history of co-operation and exchange had been built up by geophysicists, and an organizational complex reflecting this fact existed in a close network of national and international scientific societies . . .

"The next important point to make is this. The IGY was indeed relatively free of politics. It is quite probable, however, that this was true only to the extent that political considerations were not directly involved. Where political considerations existed, they made themselves felt. The participants either side-stepped them or in effect yielded. I doubt that it can fairly be said that the IGY solved any political problems. Thus, the question of Chinese representation plagued even the IGY programme.

"More important for our concerns here, the broad success which characterized the scientific effort in virtually all other fields did not really extend to the IGY programme in space research, where, it is now very clear, the Soviet Union had political rather than scientific object-

Missiles and Spaceflight . . .

ives. Soviet intransigence greatly restricted the IGY agreements for exchange of information in this area. As a result, unanimous consent to broader agreements could not be obtained. And Soviet compliance with even the modest IGY requirements in space science was largely *pro forma*. Attempts to improve the situation, though made through the international scientific machinery of the IGY, were totally unavailing.

"Essentially the same situation continues today in COSPAR which is the scientific community's extension of IGY in the space-research field. One is therefore led to adopt, at least as a working assumption, the tentative conclusion that scientific groups, while contributing toward international understanding in common with many other types of international links—commercial, religious, cultural, etc—may not in fact have a *special* capacity for direct resolution of political problems . . .

"This is very far from saying that international scientific organs do not have a very positive role to play in increasing contacts, contributing to general understanding, and achieving specific goals, as in the IGY, which inspire and stimulate confidence in the ability of people to work together. It is important to recognize also that those who moulded the IGY were probably far freer from disabling political considerations than governmental representatives attempting to frame a similar scientific programme would have been. The scientists were not obliged to negotiate within the limits of inter-governmental positions, relationships and commitments which must properly concern the political representative.

"This, together with an appreciation of the value of the entire system of national and international relationships invoked by the scientists in the IGY, suggests the wisdom of using scientific mechanisms to achieve scientific objectives rather than seeking the same results and understanding through political channels.

"The IGY and COSPAR together have made another very great indirect contribution. Conceived essentially to map an arm's-length type of co-operation, they have specifically excluded themselves from closer bilateral arrangements. Yet they have provided invaluable forums for the technical associations which alone can engender meaningful bilateral programmes. Thus, while inspiring programmes very different from the popular conception of close inter-governmental relationships, the IGY and COSPAR have nevertheless contributed to the establishment of programmes which come much closer to this ideal of nations working closely together in common projects. Indeed, COSPAR was the forum in which the US launches its own bilateral programme of international co-operation in space research . . .

"The US programme of international co-operation in space research is primarily the responsibility of the National Aeronautics and Space Administration. It seeks to provide opportunities for foreign scientists to participate in our experiments, to send experiments of their own into space by means of our sounding rockets or satellite boosters, to train technicians and scientists here in support of their own or joint programmes, and to participate in the operation of the global tracking and communications network.

Bilateral Programmes

"Keep in mind that space research is new and costly, that it rests upon the most advanced technologies, that it requires nationally-supported efforts for significant programmes, that such programmes require planning, authorization, organization and funding, and finally that long lead-times are involved. Given these limitations, the US has nevertheless developed a wide range of bilateral programmes. Their scope can be quickly indicated:—

"Two countries are now completing the preparation of satellites to be launched by NASA next year. A third such programme is covered by agreement and three additional programmes are in various stages of discussion.

"NASA has engaged in co-operative sounding rocket programmes with five countries, joint operations having already occurred in four cases, agreements have been concluded in three more cases, and four more co-operative programmes are in more or less advanced stages.

"Nearly thirty nations are participating in NASA's meteorological satellite programme by mounting special observations of cloud cover and other weather aspects, synchronizing these with passes of the satellites overhead in order to correlate the data from both sources. Four nations are building large ground terminals for co-operative testing of early experimental communications satellites.

"The greater portion of some two dozen NASA overseas tracking and communications facilities are operated wholly or in part by foreign technicians and scientists, are available to them for their own scientific use, and in some cases are actually supported by them. Additional countries receive and provide data for use in special programmes. Some 20 countries in all participate in these operations. Some 17 countries have now sent personnel to the US under several programmes which provide training opportunities in our laboratories and universities.

"Allowing for duplications, over 40 countries are sharing in our space programme in some way. Since there were only half-a-dozen nations with space programmes during the IGY and today only 17 are members of COSPAR, the extent of the US bilateral programme is in itself of some significance. Indeed, it has already been productive of additional memberships for COSPAR . . .

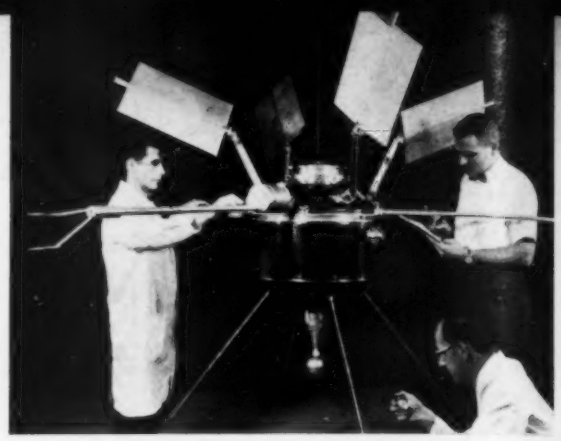
"But, apart from its extent, the philosophy of this programme is of some interest. Like the IGY-COSPAR effort, the NASA programme assumes that the proper well-spring of meaningful co-operative effort is discussion and planning by technical personnel. Governments are kept informed and agreements concluded only with their knowledge and consent, but the interest, feasibility and implementation of joint projects are determined by technical personnel. (The fact that the programme has not yet succeeded in including the Soviet Union again suggests that political barriers are not peculiarly susceptible to science.)

"Next, valid scientific objectives in the mutual interest are sought; artificial goals are avoided. To preserve a truly co-operative character, joint projects are expected to grow out of joint inputs. There is no exchange of funds, no export of dollars. This ensures that *both* co-operating parties enter into the programme with care and deliberation in the interest of considered objectives . . .

"Such a programme provides real opportunities for American and foreign scientists to contribute to man's investigation of space in an atmosphere of mutual respect, stimulates interest abroad in the latest technologies, adds to the net total of productive research, conclusively demonstrates the remarkable openness which attaches to US space research, and is clearly contributing to understanding among peoples.

"There are, of course, limits to bilateral arrangements, for the cost of space activity puts even a meaningful bilateral effort beyond the resources of many interested and competent countries. As a consequence, a strong movement has developed in Europe to develop a space programme on a regional, multilateral basis. Some eleven countries are involved and preparatory organizational and programming measures are underway. Again, while governments are officially engaged in this effort, the planning and negotiating of what is essentially a technical programme is in the hands of scientists. The progress of such a multilateral effort will depend in part on the division of effort the principal participants make between their own national programmes on the one hand and the European programmes on the other . . .

"Of critical importance for the continuing efforts of the free world to establish international co-operation as the mode of space research will be the direction which the European group as a whole takes in this regard. Thus far, we are encouraged to expect a fruitful partnership. For instance, the European group, in planning a ground network, has conferred with NASA operating personnel and expressed its interest in a compatible system permitting mutual assistance. We, for our part, have repeatedly emphasized our desire to co-operate with the prospective organization in any mutually helpful way and are, in fact, prepared to meet the mutual obligations of a truly meaningful partnership.



International co-operation was the subject of Mr Arnold Frutkin's paper. Here the first US/UK joint ionospheric satellite prototype is seen being subjected to test of moments of inertia about its spin axis at NASA's Goddard Space Flight Center, Greenbelt, Maryland. The actual satellite will be launched from Cape Canaveral by Thor-Delta vehicle during the first quarter of next year

The Soviet Attitude

"In this rapid review of the character of the principal forms of international co-operation in space research today, I have said virtually nothing of the Soviet Union. There is little to be said since the Soviet Union has not figured significantly in any co-operative effort in space research either in the world at large nor, indeed, is there any evidence that it has deigned to give of its resources or experience to its own satellites beyond the Iron Curtain.

"In a recent article in a Soviet journal, G. I. Pokrovsky stated, 'Soviet scientists, engineers and workers who have created the most advanced rocketry in the world have secured for their country the leading place in space studies. Hence it is natural and inevitable that the Soviet Union should rightly play the leading part in the international efforts in space research. This role in no way infringes the interests or prestige of other states. On the contrary, this should be one of the forms of disinterested scientific and technical mutual assistance in consolidating peace and international co-operation.'

"In fact, the Soviet Union cannot point to a single significant *joint effort* in space research with a foreign nation. It has asked (and received) the assistance of Jodrell Bank in tracking its space probes. It has asked (and received) the assistance of stations in the US tracking net on various occasions. On the other hand, it has, so far at least, rejected or failed to follow through on every proposal for substantive co-operation in space science made by the US or the scientists of other nations and, so far as we know, has been unresponsive even to requests reportedly made by its satellite nations desiring assistance for operational space research. It has effectively blocked a purely scientific symposium on space research under United Nations auspices in order to exact a political price which would give it a veto over the activities of other nations in meeting the problems of outer space.

"The fact is that the Soviet Union neither leads nor follows in international efforts in space research.

"To sum up, analysis of three major modes of international co-operation in space science suggests that they represent unlimited possibilities for multiplying useful and constructive relationships among the nations and that they constitute effective mechanisms for achieving appropriate, i.e., scientific, objectives. Little evidence, however, suggests that we may look to science for particular assistance in resolving substantive political problems. . . ."

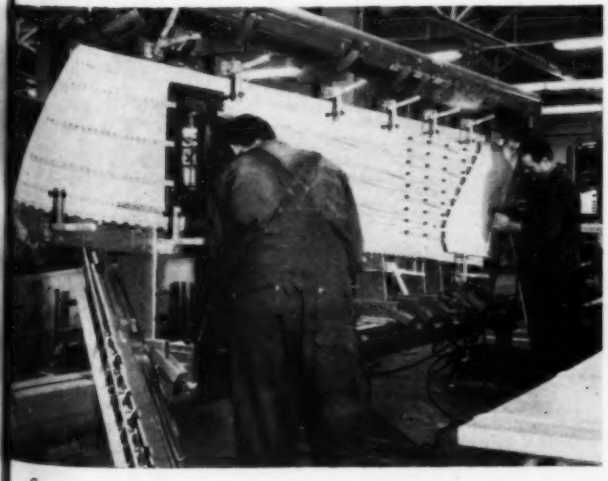
F-104G centre fuselages being made by Dornier at Neuaubing

The German Industry

THE AIRFRAME MAKERS: FROM LICENSED BUILDING TO PROJECTS

611 The Airframe Makers
621 Industry Directory
622 Super Starfighter
629 Aircraft, Engines and Missiles

Fiat G.91R3 wing panel being made by Heinkel



RISEN like a phoenix from the ashes of the Third Reich's industry, the new German aircraft companies have reason to be proud of the progress they have made in five years of post-war existence. From almost literally nothing, they have progressed in that time to the production in quantity of one of the world's fastest strike fighters and to the design of modern aircraft of their own.

By 1945 most of the factories had been destroyed by air and ground attacks and what had not been destroyed was then systematically dismantled and taken away. Skilled personnel were dispersed, either being taken to other countries or driven by necessity into other industries.

Then came an interval of ten years' enforced idleness during which no aircraft development was allowed. The workers who remained in Germany were perforce absorbed into other work, so that while aircraft technology and design were moving ahead faster than ever in other countries, German knowledge and skill lay virtually dormant. When sovereignty, and with it permission to make aircraft, were granted again in 1955, the companies had to start from scratch, the only ready-made resources being the former skill and knowledge they could attract back to aircraft-making from abroad and from other industries. The "Wirtschaftswunder" which set West Germany as a whole on its feet largely passed the aircraft industry by.

As soon as the German aircraft companies began to organize

Pre-flight inspection of a G.91R3 at Dornier's Oberpfaffenhofen factory

Assembly-line overhaul of Republic F-84Fs by Weser at Lemwerder

The German Industry . . .

themselves in 1955 and 1956 it was obvious that a major commercial opportunity existed for foreign companies to take part in one way or another. Many countries successfully took this opportunity, but Britain seems to have missed the boat. One German airframe manufacturer reported that, in 1955, approaches were made by almost every major manufacturer in the USA, France and Italy, but that not a single British company came forward. A very large number of licence agreements were signed or direct orders obtained, but Britain's share has been relatively small. Only in the engine field have we been at all successful. Subsequent efforts to struggle into the market from a position of inferiority have had only limited success.

Britain's apparent detachment from continental Europe is only now breaking down, but German companies have all along been thinking on a European scale. The Transall and Atlantic projects are to them perfectly logical procedure—in fact a necessity because of their relatively limited resources. Any reasonable co-operation proposed would have been entertained in the early days of 1955 and 1956. Those arrangements that were most forcefully shown to be of advantage were accepted and have since been implemented. It must be said, however, that the sales campaign mounted by certain American companies, notably Lockheed, has proved virtually invincible and far broader and more ruthless than almost any European company would have envisaged. The F-104G programme has itself led to numerous minor commercial competitions which have been fought with equal ferocity—again with little success for British companies. There is a complicated story behind the replacement by the Lockheed C.2 ejection seat of the Martin-Baker unit originally specified for all F-104Gs. Martin-Baker seats have been retro-fitted to most Luftwaffe aircraft of American origin.

A considerable campaign is now being run by Northrop for adoption of the T-38 Talon as companion trainer to the F-104G, but on the whole the "battling days" may be coming to an end. The German companies themselves will now to a greater extent be able to take the initiative and make their own alliances. So long as genuine co-operation is offered, the prospects for non-German participation will probably be more evenly distributed.

The resurrection of the German industry seems to have fallen quite naturally into two phases. The first phase was to establish the ability to build up-to-date airframes with all that this implied in relation to the ten-year hiatus—training, re-training and re-equipment. The resources and orders necessarily came from government contracts for military aircraft within the framework of Germany's own contribution to NATO.

During the hiatus, some of the old German aircraft firms, notably Heinkel, Messerschmitt and Dornier, had preserved a commercial existence by taking up precision engineering of one kind or another. Scooters, precision machinery, domestic appliances, textile machinery, sewing machines served to build up new factories, keep skilled labour on hand and to retain at least the commercial existence of some companies. A few designers worked independently abroad before 1956 to develop new aircraft—as opposed to working with foreign companies on foreign projects. Notable products were the Pulqui fighters in the Argentine, the Hispano 200 and Dornier Do27 in Spain, the Beja Flor helicopter in Brazil and, most recently, the Hindustan fighter in India.

Of these projects only the Do27 and Beja Flor returned to Germany after 1956; and only the Do27 has survived there. Nevertheless the Dornier project and its derivative the Do28 proved highly successful; and they are still the only indigenous designs to have reached substantial production.

Despite the remarkable achievements of the first five years, the industry is still based of necessity on the production of specific military airframes, engines and equipment. But indigenous design and civil production are increasing fast, even though they still account for a small proportion of the total effort. The industry itself, employing between 20,000 and 30,000 people, represents a very small portion of the national industry.

If the first phases of reconstruction consisted mainly of putting into production modern, but established and straightforward, foreign airframes; the second stage has involved a similar process, but on a broader basis and with much more advanced aircraft. Engine building in the first years was confined to the licence production by BMW of Lycoming piston engines, and very little was done in the equipment, instruments and electronics field. But the next stage saw the licence production of the mighty General Electric J79 by BMW and the production of a considerable part of the complex equipment for the F-104G and G.91. At the time when the F-104G programme was begun, a similar programme would have exercised the abilities of even the established European aircraft industries, but the German industry has shown itself fully capable of tackling such an ambitious task. Productionwise, as the Americans would say, it has achieved its maturity, for the F-104 involves virtually every modern technique and material. Make no mistake about it, the F-104G is in production in southern Germany, on schedule and well made.

The resources of the industry as a whole are, however, still fairly limited, both in financial backing and in design capacity; and both of these can only be improved with the passage of time, with an accumulation of business turnover and profits, and with the building-up of experienced design teams. Participation by Dornier in the NATO Atlantic programme and by Weser, Hamburger and Blume in the Transall is a first step towards design experience and towards a sounder, broader basis for the competitive future.

Individual companies in the southern area were not able to assemble sufficient design capacity to tackle major projects by themselves. Heinkel, Messerschmitt and Bölkow therefore contributed teams to the Entwicklungs Ring Süd in Munich, which is charged with development of a variety of projects under government order. The Ring has no financial capital and the men continue to be members of their respective parent companies. No German company would at this stage risk losing its most highly prized asset, the able designer.

As far as the future is concerned, neither government nor industry are planning any major increase in the overall capacity of the industry. But the companies are keen to broaden the basis of their activity and to introduce civil work as a leavening to the necessarily unpredictable military order-book. Indeed, the military work should ideally take second place. The balance of work and capacity is at present even, at least in the south, but in three years' time new projects will be required, and design for these, if they are to be indigenous, must begin now. Financial support from outside is a basic necessity. It remains to be seen whether the new ventures, whatever they are, will be predominantly national, with groups of companies working together in Arbeitsgemeinschaften, or internationally, with Germany, Italy and France working together, or European, with Britain joining in.

Because the early orders for military aircraft built under licence had to be equitably spread between the companies, co-operative groupings known as Arbeitsgemeinschaften were set up, but were not based on any actual commercial merging of the companies concerned. Such co-operation is still very much the normal procedure and indeed dates from the days of the Third Reich. The Entwicklungsring is just such an organization under a different name.

Hamburger Flugzeugbau works beside the Elbe at Finkenwerder

In the present activity an Arbeitsgemeinschaft consisting of Messerschmitt, Dornier and Heinkel is making the Fiat G.91, with Dornier responsible for final assembly and test flying at Oberpfaffenhofen, near Munich. The same companies and Siebel are co-operating to make the F-104G, Messerschmitt having built the new works and airfield at Manching for final assembly and testing. Weser, Hamburger and Focke-Wulf have more recently joined the North group, with Fokker and Aviolanda, to form a second source for F-104Gs.

An Entwicklungsring Nord has just been formed by Hamburger, Weser and Focke-Wulf, and one of its tasks perhaps will be to tender for the NATO Military Basic Requirement 4 for a V/STOL transport to support the Traumjaeger project. Focke-Wulf exhibited at Paris a multi-engined lift pod for a transport aircraft and they have established a close relationship with Hawker Aircraft at Kingston. Weser are working with Sikorsky on helicopter development, particularly on the WF-S-64 crane helicopter. They are likely to be involved in manufacture of the cargo helicopter for the German army, when the type is decided. At present it seems likely that the Sud Super Frelon, in which Sikorsky are also co-operating, may be chosen.

On the whole, the rumours are far ahead of the facts, according to the German companies themselves. There are many ideas, but the ultimate decisions are not for the companies to take and the web of international agreements and NATO schemes must first be smoothed before a concerted programme can emerge. Certain it is that Germany prominently figures in the market, both as customer and as manufacturer.

As far as government direction and financing of the industry is concerned, there is some room for complaint in that not only does the industry deal with three federal ministries (Defence, Transport and Economics), but it is at least influenced by the equivalent offices in the various Länder or provinces. Such a partial decentralization creates considerable difficulties and there is some agitation for the formation of an equivalent to the British Ministry of Supply or Aviation.

The German industry's main customer is the federal ministry of defence, which maintains an aeronautical test establishment (Erprobungsstelle der Deutschen Luftwaffe) at Oberpfaffenhofen. The ministry of transport is responsible for all civil affairs such as airworthiness and personnel licensing. The economics ministry also has some control of the aircraft industry in the national economy.

While the Erprobungsstelle der Deutschen Luftwaffe, as the name implies, deals only with specific air force projects and equipment, basic research is distributed among a variety of large and small organizations whose work and financial support is co-ordinated by the Deutsche Gesellschaft für Flugwissenschaften at Martin Strasse 24, Bonn. The various organizations are, apart from the central co-ordination, independently run; and finance is contributed not only by the federal defence, transport and economics ministries but also by the governments of certain of the Länder, notably Nord Rhein Westphalen and Bavaria.

The most important basic research organization is the Deutsche Versuchsanstalt für Luftfahrt (DVL) at Mülheim, shortly moving to Cologne. Others are the Deutsche Forschungsanstalt für Luftfahrt (DFL) at Braunschweig (Brunswick); the Aerodynamische Versuchsanstalt (AVA) at Göttingen; the Flugwissenschaftliche Forschungsanstalt München (FFM) at Munich; the Deutsche Studiengemeinschaft für Hubschrauber, the helicopter research station at Stuttgart; the Forschungsinstitut für Physik der Strahlantriebe, directed by Dr Saenger at Stuttgart; and the Arbeits- und Forschungsgemeinschaft Graf Zeppelin. Outside this main grouping is the Wissenschaftliche Gesellschaft für Luftfahrt (WGL). The last two organizations mainly organize conferences and specific studies and have no installations of their own.

The manufacturers have an association equivalent to the British SBAC in the Bundesverband der Deutschen Luft- und Raumfahrtindustrie. The Raumfahrt portion, referring to space flight, has been added recently as a result of Germany's participation in the European space programme.

Messerschmitt AG

ONE of the larger companies, in terms of man-power, in the German aircraft industry is Messerschmitt AG, which is re-established at its traditional headquarters at Augsburg. The old test airfield is now a US Army helicopter and light aircraft base and 75 per cent of the original buildings were destroyed during World War II. The old headquarters building is now the apprentices' training centre and the new factory has been built farther down the road. Head- and design-offices are in Munich.

Factory floor area is now 42,500sq ft and work force about 3,000. Of the 10,500,000 DM capital (about £950,000), the Messerschmitt family holds 51 per cent and the Bavarian Government the remainder. Messerschmitt also holds a half-share in the Flugzeug-Union-Süd GmbH, the remainder being held by Heinkel. FUS holds all the stock of Junkers Flugzeug- und Motorenwerke AG of Munich.

On a small scale, Messerschmitt made sewing machines after World War II and began the production of the well-known three-wheel scooter. The first aircraft programme, for which modern new buildings were erected, was the manufacture of the Fouga Magister in association with Heinkel. Messerschmitt made the fuselage and assembled and tested the finished aircraft. Magister construction is now completed, 210 having been made, but the company retains the major overhaul work, the base for which is now being moved from Munich Riem to Manching. German air force T-33s are also overhauled.

Messerschmitt is now concentrating almost exclusively on making the forward fuselage and tail of the Fiat G.91 and on making the forward fuselage of, and assembling and test-flying, the F-104G. For these two projects the factory at Augsburg is extremely well equipped and laid out, with the most modern machinery. Just one tool has survived from pre-1945 days—a noisy but still effective drop hammer. Presses, stretch-presses, electronically controlled copy miller, several types of spot-welder and a large assortment of smaller machine tools are all new.

A rail siding leads straight to the reception stores with adjacent

Final assembly of German-built F-104Gs by Messerschmitt at Manching

inspection building. Materials are transferred to the fabrication shop whence cut and shaped sheet parts are fed out to the presses and welding machines. A very large heat-treatment oven is set some 10ft off the ground so that the parts can be dropped within 2sec into a quenching tank set in the floor. An outside refrigerator is available for storing large or small parts at −20°C to keep them workable for as long as necessary.

Detail parts are finally inspected and stored in a pen at the end of the detail section of the main works. From here kits of parts are issued at appropriate times direct to the small jigs on which sub-assemblies are made up, eliminating any fetch-and-carry movement by assembly-line workers. Progressively larger sections of G.91 and F-104G are then progressed along the parallel production

Above, parallel assembly of G.91 noses and tails by Messerschmitt and, left, the jig and tool department with the G.91 master jigs on the right

lines until the G.91 nose and tail are complete and the F-104 nose is mated in its two-level access platforms to the centre-section contributed by Dornier. The F-104 fuselage is piped and wired while still in its split left and right halves—preformed piping and wire looms are universal—but the G.91 assemblies are completed only structurally before being transferred to another hall for furnishing. G.91 sections finally emerge for shipment to Dornier complete with their 30mm guns, nosewheels, instruments and powered control units.

Messerschmitt are proud of their jig and tool department where they make their own stretch-press dies and have constructed their own massive master jigs for the G.91 nose and tail. The latter were sent to Fiat in Turin for checking before they were used. For the G.91, but more especially for the F-104G, complete interchangeability of major components built in any one of several countries has been specified. The airframe itself calls for much close tolerance work, but very considerable trouble is also taken to ensure adherence to master dimensions supplied to all licensed manufacturers by Lockheed. Some master jigs and patterns come from Lockheed at Burbank.

Master drawings at full scale on highly stable plastic sheet are photo-projected by Messerschmitt on to metal sheet, using a process by which a number of sheets can be marked as accurate positive prints from a single projection. Some of the sheets are used as drilling matrices for sheet parts. From the master drawings, too, large numbers of master templates are made, for there is hardly a straight line or uncompound curve anywhere in the F-104 airframe. It says much for both Messerschmitt and Dornier that they have taken to this high-precision work with obvious efficiency and determination. There seemed to be no problems and no hold-ups.

While the two G.91 fuselage sections are shipped by road from Augsburg to Oberpfaffenhofen, the mated Messerschmitt and Dornier F-104 sections are taken to the brand-new assembly and pre-flight centre at Manching, where a new 11,400ft × 390ft runway has been laid through the woods parallel with that of the existing Luftwaffe F-84F base. The Lockheed-built F-104Gs are already being assembled here and the first three German-built aircraft were in assembly when I paid it a flying visit. The first one was in fact in its final pre-flight check and could have flown within hours. It is due to be handed over formally to the Luftwaffe as this issue goes to press.

At Manching a 440ft-long open-ended hall is being prepared for line-assembly of F-104Gs and a two-storey electronics block stands hard by. An engine test-stand is also being built. Manching's task is to assemble Heinkel wings to Messerschmitt/Dornier fuselage, fit Heinkel fin and tailplane to Siebel steel and titanium tail, install the BMW J79 engine and the battery of RCA and Litton grey boxes of electronics and the Vulcan gun. The Lockheed C.2 seat, now standard on all F-104Gs, is offered up through the former downward-ejection hatch and pre-flight check-out begins. Flap-blowing is checked with " rakes " of wool-tufts behind each wing. Incidentally, that first German F-104 was a fully operational aircraft, complete with gun, Nasarr radar and all other electronics. It was in no sense a pre-production aircraft and carried no test instrumentation.

Although the production line for F-104s at Augsburg is not yet fully loaded, the flow is well under way and the side panels of No 15 forward fuselage were in jig and nearing structural completion. The G.91 line appeared fully loaded.

Messerschmitt has the firm intention of entering the civil field and of diversifying its production. Prof Willy Messerschmitt is taking part in design studies and a group of designers is working with the Entwicklungsring Süd. The company firmly stated that a VTO fighter, nicknamed Traumjaeger (dream fighter) and frequently given the designation VJ-101, is only one of several possible ER Süd ventures and not necessarily a firm project. In their own right Messerschmitt are investigating civil projects and seriously considering entering the commercial space-flight field.

Dornier-Werke

AS a family-owned, private-stock company which maintained its existence and individuality during the ten-year post-war hiatus, Dornier holds a distinctive position in the German aircraft industry. It has taken part in the main Arbeitsgemeinschaft programmes and done a considerable share of overhaul work on F-86Ks and Sabre 6s and Vertol 44s through its subsidiary Dornier Reparaturwerft, but it also stole a march on the others with the development in Spain before 1956 of the Do27. More than 500 of these have now been made by Dornier and the last few for the German army and air force are being slowed down to allow export deliveries to be brought forward. More than 130 civil Do27s have been delivered. The Do28

is also successful and the 26th was in final assembly at Oberpfaffenhofen, where all 27s and 28s are made. The first Do28 to be delivered across the Atlantic, for Elenco of Plymouth, Wisconsin, was drying its red and white paint, and Do27s for the Belgian army were awaiting delivery. A Do28 was being prepared for Katanga.

Dornier makes the centre fuselage and assembles and tests the German Fiat G.91; and at least half a dozen, camouflaged and bearing Luftwaffe crosses, were in the neighbouring part of the pre-flight hangar. The first German-built G.91 flew on July 20. Each new aircraft is flown for between five and ten hours, in 45min to 1hr flights, while PHI, Doppler and other of its systems are checked. The two 30mm cannon are mounted with their barrels a foot or so proud of the fuselage, the muzzles being flanked by stainless-steel plates. Cameras are in the nose and four pylons under the wings, drop-tanks being hung inboard.

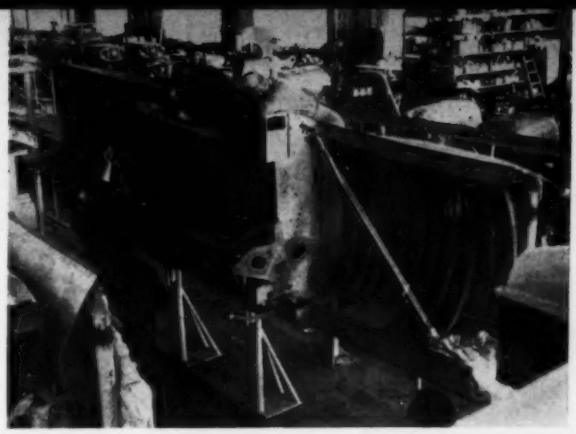
As in the F-104, the central blind-flying instrument in the G.91 is the PHI course and distance indicator, the two-coloured SFENA drum horizon being mounted rather insignificantly on the right. Most flight instruments appear to be miniaturized and two tiny turn-and-slip indicators are mounted side-by-side at the foot of the blind-flying panel—surely the original diagnostic challenge to the pilot in the unlikely event that one of them fails.

Dornier are still consistently pursuing STOL performance, having investigated Benson gyrocopters, various modifications to the Do27 and flown three of the remarkable propeller-tilting Do29s. Two of these are lying idle for the moment at Oberpfaffenhofen while the third is being flown by the Luftwaffe experimental establishment. It is hoped soon to start a series of trials designed to establish suitable airworthiness criteria such as minimum steady-flight speeds and approach techniques. At the end of earlier tests, some 50 per cent of the lift was being provided by the pusher propellers tilted down between 75° and 90°. No immediate development of the Do29 is intended at this stage, but a Do31 STOL transport project has been reported.

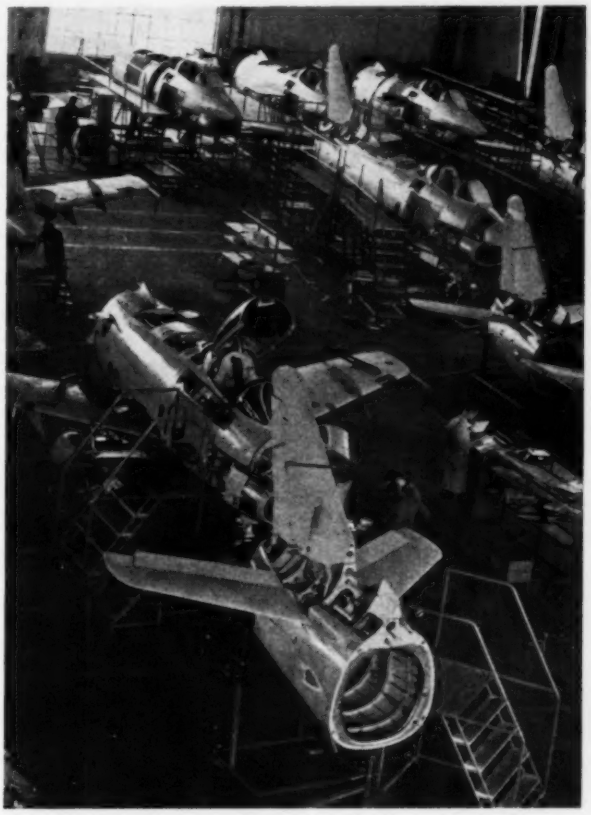
Next production aircraft in the line will be the new Do346, a three-engined 10-15 seat extrapolation of the Do29 with rear loading. It will have 380-390 h.p. Lycoming or Continental engines and extended Do28 wings. The Do346 is intended as a utility aircraft for undeveloped areas and might eventually be powered by Turboméca Astazou turboprops.

While the Oberpfaffenhofen factory is responsible for G.91 assembly and for complete production of the Do27 and 28, the factory at Neuaubing, nearer Munich, contains the head offices of the aircraft section of Dornier—the textile machinery works and overall head offices are at Friedrichshafen. Neuaubing is also the Dornier centre for production of the centre fuselage of the F-104G and centre fuselage and tailplane of the G.91. Ten of the F-104 sections and 14 G.91 sections have already been delivered and the rate of production, as elsewhere, will soon reach respectively six and seven per month.

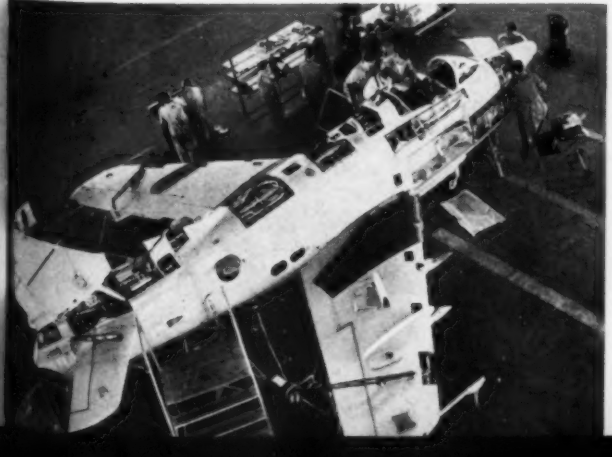
Like Messerschmitt, Dornier are extensively equipped with a 250-man jig and tool department and comprehensive modern machinery. Their portion of the F-104 also includes several titanium sections in the hot parts of the engine body. The building from detail parts through piped and wired side panels to fully equipped fuselage section with fuel tanks installed is similar to that at Messerschmitt and the same two-level travelling assembly frames are used. Dornier have departed from the Lockheed scheme only in employing much more massive jigs with optical alignment, a procedure which, they say, has already greatly assisted in obtaining the high accuracies demanded for international interchangeability of sub-assemblies. Dornier had designed their own quick-quenching system in which the whole oven, mounted at ground level, can be tilted to roll the hot parts down a sloping rail on a dolly and straight into the quenching tank sunk in the factory floor. There was also a −20°C cold-storage chamber for semi-finished components.



Above, shells of the F-104G centre fuselage being equipped at Neuaubing by Dornier. The intakes are provided by Siebel



Below, final assembly of a G.91 by Dornier at Oberpfaffenhofen. Rate of production is working up to seven per month. Above, joining of Messerschmitt and Dornier fuselage sections, also at Oberpfaffenhofen



While Dornier have not joined the Entwicklungsring Süd, they have not remained aloof from the international design field. They have designed and made the tail cone of the Breguet 1150 Atlantic, the first section being already incorporated in the first prototype at Toulouse. The glued metal honeycomb portions of the structure have been sub-contracted to Siebel.

Dornier is therefore in the very sound situation of having a goodly slice of the licence building programme, a foot in the international design field and a flourishing design and production business of its own with considerable civil sales. In connection with the last-named activity, I was at Oberpfaffenhofen on a foggy evening when Dornier's famous demonstration pilot, Schäfer, came in in a

Above, Bölkow's high-speed rotor with lead-lag blades. Below, the Bölkow Cobra with its deflector plate under the tail. When the tail-cap is removed the spoiler guards spring away

The German Industry . . .

Klemm 107c, fresh from a Do28 demonstration in Greenland. Flying with a new ski undercarriage, he had made about 150 take-offs and had carried two oil-drums at a time into the high glaciers. Another task was to fly for up to 9hr leading ships through the pack-ice. The tour had obviously been a great success and sales prospects were bright. Do27s and Do28s have now made demonstration tours in most parts of the world.

Bölkow-Entwicklungen

ONE of the youngest and fastest-growing of the German aircraft companies, the Bölkow group was formed, and is directed by, Dipl. Ing. Ludwig Bölkow. While he himself retains ownership of the original nucleus, Ingenieurbüro Bölkow, the main organization is centred on the Bölkow Entwicklungen KG with head offices at the former Luftwaffe wind-tunnel site at Ottobrunn, a short distance south-east of Munich. The Ingenieurbüro specializes in design and development in precision engineering and electronics, while Ottobrunn is engaged on numerous defence ministry contracts in the missile, VTOL and helicopter field. The two most important among these are undoubtedly the Cobra anti-tank missile programme and the Bölkow participation with a sizable design team in the Entwicklungsring Süd.

The main member-company of the group, Bölkow-Apparatebau GmbH, based at Nabern/Teck, is responsible for Cobra production. A new factory at Schrobenhausen is devoted to Cobra assembly. With large orders in hand for the German army, an evaluation order for 250 from Holland and prospects of orders from Denmark, Italy, Norway and elsewhere, the Cobra programme is moving into top gear. Bölkow at Nabern includes the fixed-wing interests producing the F.207 four-seater, Phönix high-performance glider and Bölkow Junior. The score of 102 Heli-trainers so far made and a desk-top tape recorder called Conferette are also Nabern products. There is a new factory for fixed-wing aircraft at Laupheim.

Finally, Bölkow has a one-third interest in Waggon- und Maschinenbau GmbH at Donauwörth, north-west of Munich, which includes full ownership of Siebelwerke ATG, making Noratlas sub-assemblies, the 222 touring aircraft and 223 trainer, F-104 intakes and rear fuselage and metal honeycomb portions of the tail of the NATO Atlantic under sub-contract from Dornier.

The group certainly has exceptionally wide interests and versatile capabilities. In the mock-up stage is a one- or two-stage high-altitude sounding rocket with recovery parachutes for both stages and a system for returning the rocket to the launch site after burn-out. Bölkow are reported to be working on a semi-automatic version of Cobra and on infra-red techniques possibly intended to supplement defence radar at low altitudes. They will very probably feature prominently in the electronics portion of any new German weapon system.

In addition Bölkow claim to be the only company in Germany engaged on basic research in the helicopter field. Their high-speed rotor with pivoted lead-lag blading is quite new and a prototype helicopter to test the rotor should fly in 1963. The 102 Heli-trainer has been followed by the single-seat 103 helicopter, powered by an Agusta 82 h.p. piston engine, which is being used to investigate the single-blade rotor under government contract. First flights, made during this year, have proved encouraging and there is a possibility that the BMW 90 h.p. turboshaft engine might be fitted in a later version.

Bölkow feel that there are real applications for the one-man helicopter and that the one-blade rotor—its blade is of a manageably large size for production—turning at speeds above 600 r.p.m. is worth pursuing. They remain relatively unimpressed with the autogyro formula for vehicles of this size. Ability to hover, they say, is important. Autogyro payload is too small for economical agricultural use.

Although they are willing or allowed to release relatively little information concerning their helicopter ventures, Bölkow state that they want to extend their helicopter department and enter the international field with new systems and new ideas. They regard rotary-wing development as an important part of the company's work.

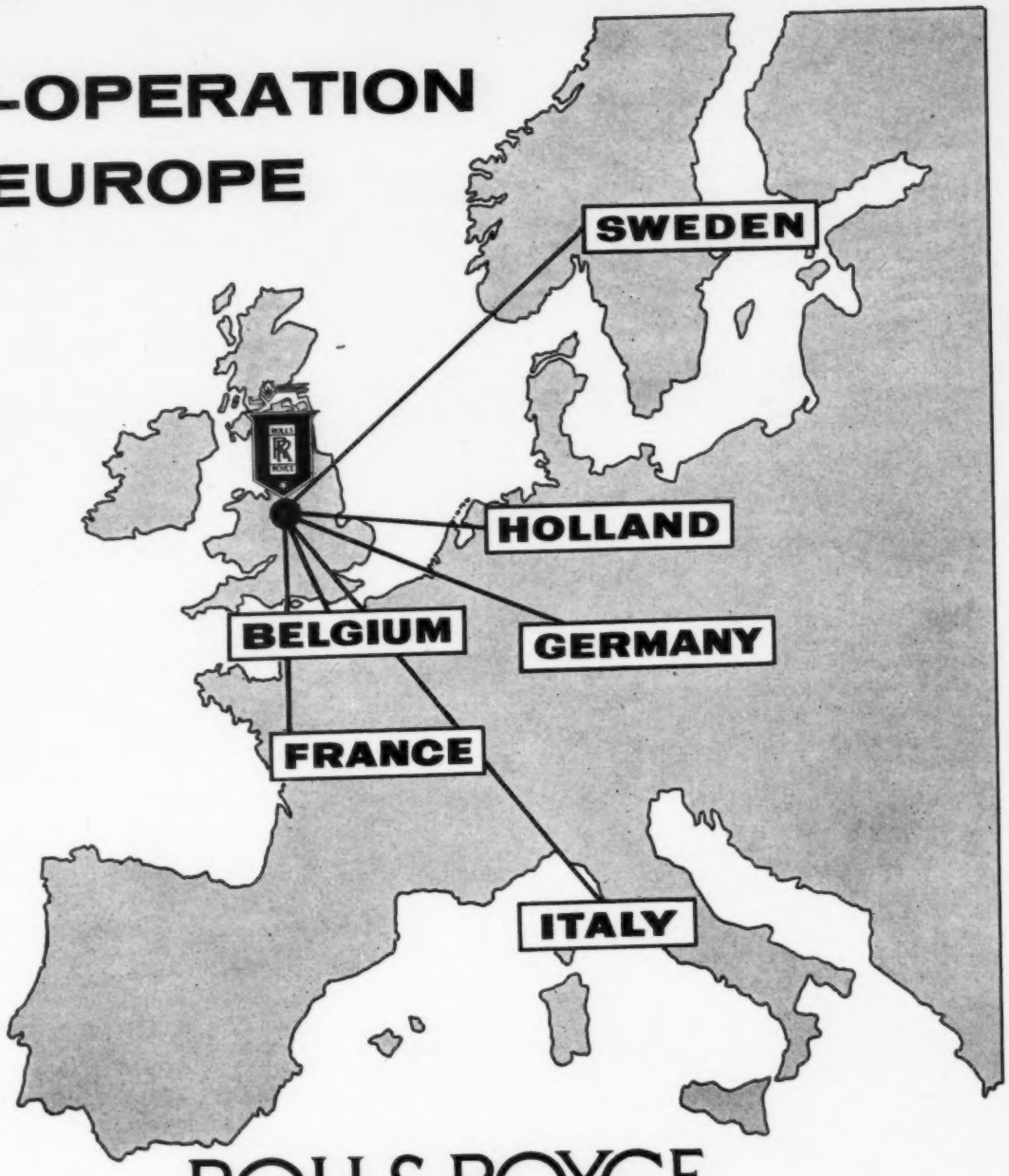
During my visit to Ottobrunn I spent some time "flying" the latest version of the 102 Heli-trainer, which incorporates a special pivoted mounting giving tilting freedom of up to 6° in any direction. Tilt and translation were formerly only possible in the water-borne trainer, but in this device the drag of the float in the water gave an unrealistic response and tended to teach pupils to over-control the cyclic stick. The fixed-base version previously allowed only vertical and turning freedom without roll and pitch attitude changes. Now, the trainer is mounted on an appropriately contoured hemispherical casting, with outrigger arms as limit-stops so that, once this portion is unlocked—and this can be done one axis at a time—the pupil must use the cyclic stick to control attitude and keep on an even keel. Bölkow state that the Heli-trainer can take the pupil right to the stage where he can fly solo in a real helicopter after only 30min dual, with consequent very considerable reduction in training cost and risk.

Earlier versions of the Heli-trainer have been supplied to the German army, France, Spain, Yugoslavia and Britain. The new land-based tilting system can be and is being retrofitted to existing machines. The normal Heli-trainer course takes pupils through all the main helicopter routines, including full pre-flight inspections—a dummy pitot head is even fitted and the cover has to be removed before "flight." First, straight lifts and descents are taught with the instructor sitting in a saddle alongside the pupil. Then turns using only rudder are taught and finally the tilt axes are unlocked one after the other. Even auto-rotative touch-downs can be induced by a second master switch controlled by the instructor.

I found that torque effects and throttle co-ordination were clearly

Bölkow's latest 102B Heli-trainer with tilting base

CO-OPERATION IN EUROPE



ROLLS-ROYCE

GAS TURBINES

Rolls-Royce co-operate closely with many aircraft and engine companies in Europe. The latest engine involved is the jet-lift RB.162 for VTOL aircraft; it is to be developed jointly with France and Germany. Rolls-Royce engines have been manufactured by European companies in quantity and the association continues with the following companies:—

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HOW'S BUSINESS AT BIRMINGHAM?

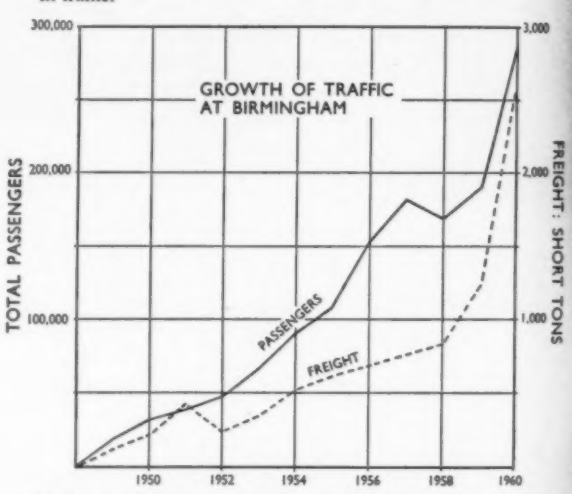
What makes Birmingham airminded?
Because business is booming in the busy Midlands. Birmingham, once a struggling community "worth twenty shillings" at the time of the Domesday Book, is now the largest provincial city in Great Britain, engaged in more than 1,500 trades including the manufacture of cars, cycles and electrical goods for the markets of the World. World trade means transport and today that means air transport. Fast travel for businessmen, fast carriage for freight. That is why Birmingham is airminded and has had an airport for more than twenty years.

How has the airport developed?
It began as a Corporation enterprise, opened by H.R.H. The Duchess of Kent, on July 8, 1939. Two months later it was requisitioned by the Air Ministry and used throughout the war as an EFTS and flight testing and delivery base for Stirlings and Lancasters. After the war, control was transferred to the Ministry of Civil Aviation, and civil flying began again on July 8, 1946. As a result of representations made by the local authorities the first scheduled air service from Birmingham to the Continent was flown on April 8, 1949. By 1951 regular services were operating to Paris, Dublin, Belfast, Jersey, Guernsey and Dinard. Nine years later, on April 1, 1960, the airport reverted to the control of the City Corporation.

And what's doing there today?
Eight airlines operate scheduled services to some 13 cities and towns in the U.K. and Europe. Seasonal and inclusive tour services are flown to another 20 cities and holiday resorts. Traffic is increasing fast and the potential growth is impressive. And at Birmingham Esso service is ideally suited to these conditions, with a compact modern installation geared to meet the current demand but ready for rapid expansion with all the resources of Esso's vast servicing organisation at its command. Resources which range from intangibles such as long experience, original thinking and an eagerness to serve, to material aspects such as up-to-the-minute plant and equipment whether it is a matter of a newly-invented Hydrafueller or a newly-opened refinery as shown below.

What has this to do with Birmingham?
This is the new Esso refinery at Milford Haven, opened by H.R.H. The Duke of Edinburgh, on November 4, 1960. Built at a cost of nearly £20 million, it supplements Esso's mighty £70 million installation at Fawley, and a considerable proportion of its initial capacity of some 4,500,000 tons annually will consist of aviation fuel. This is one of the latest examples of Esso's resources which ensure that at Birmingham Airport, as elsewhere, Esso will remain two steps ahead of current demand, however great the rate of expansion.

What are the chances of expansion at Birmingham?
This graph shows that already there is a significant increase in traffic.



Notice that in 1960 compared with 1959 the number of passengers increased by 50% and freight by 100%. This is the beginning of the upward trend and future prospects are bright, with Birmingham as a principal 'bus-stop' on the high-frequency internal routes, with helicopters linking city centres direct, with the rapid growth of executive flying and, most important of all in this centre of international commerce, with an ever-increasing flow of air freight that already has necessitated new premises for its handling.

And how will Birmingham deal with this demand?
A new passenger handling building for continental traffic was opened by H.R.H. The Duchess of Kent, on April 28, and extensive alterations to the existing terminal are in hand. The main runway has been extended and will be extended again to keep abreast of latest requirements. And as for helicopters, proposals are being considered for landing stations to be located in the city centre, for example over Snow Hill railway station. But with all these developments one factor will never change—the need for fast turn-round, never more vital than at a busy airport handling short-haul traffic—commercial traffic, where time means money with a vengeance. And this is where Esso scores, with safe, swift service backed by thorough training and vast resources which mean time and money saved.

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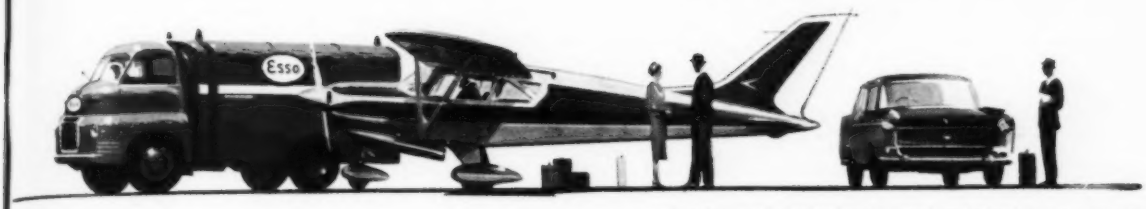

The heart of England is in touch with the heart of Holland . . . and of Belgium . . . and of France . . . Brisk turn-round at Birmingham is vital to the airlines with passengers whose sole reason for flying is to gain a few, valuable extra hours at their destinations.

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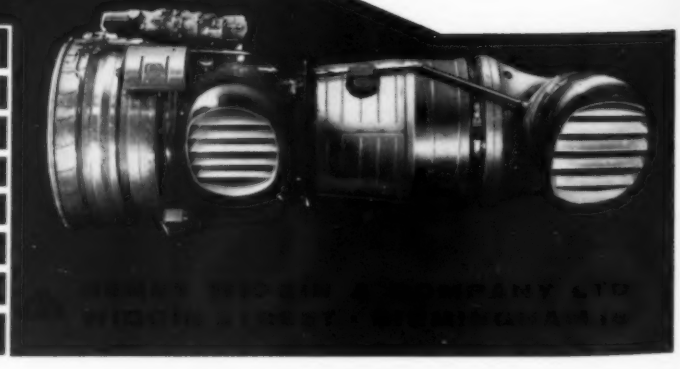

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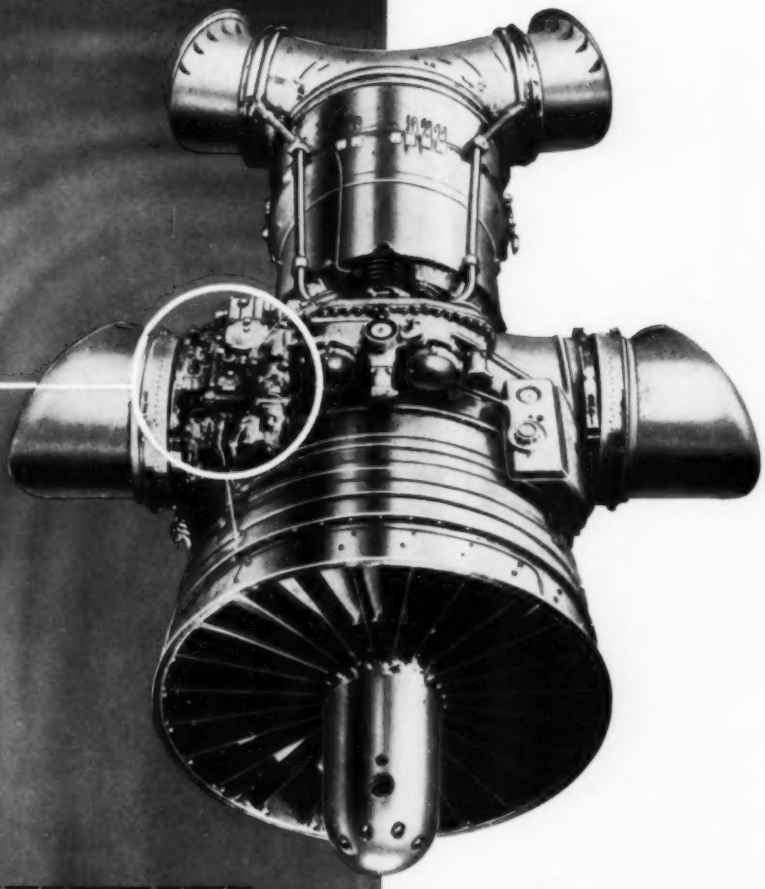
POWER FOR LIFT

POWER FOR LIFT AND THRUST



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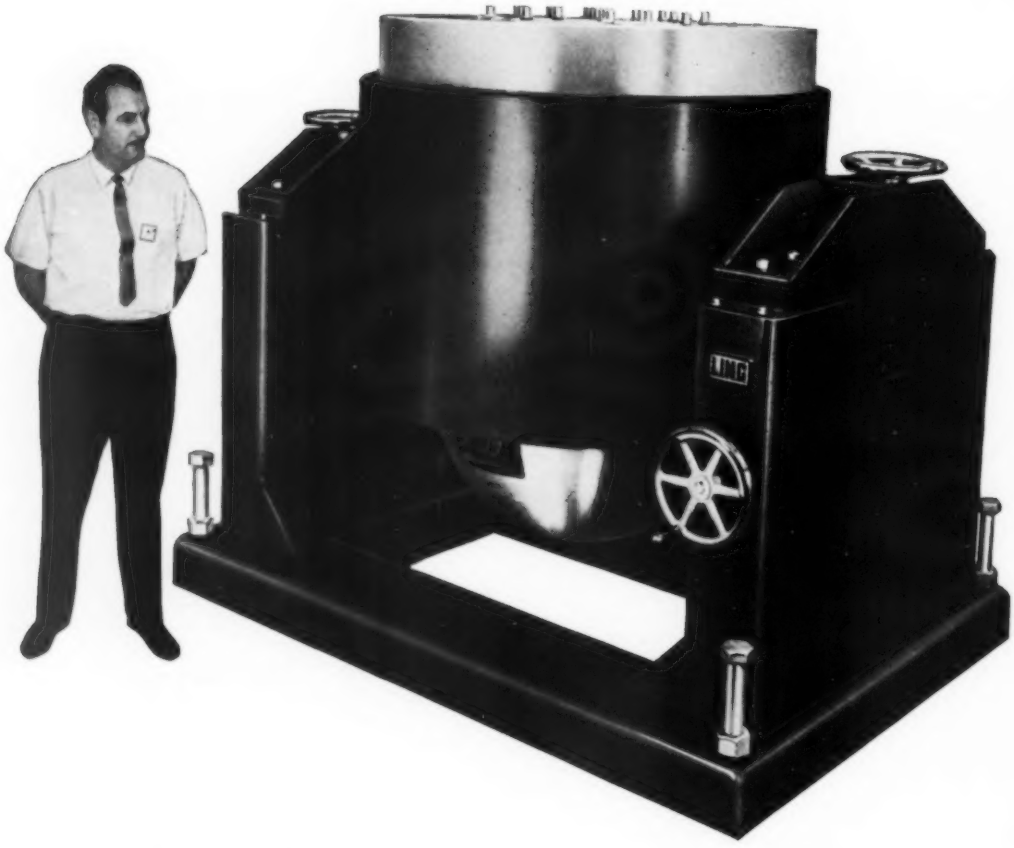

Pye, one of the foremost names in British electronic engineering, has now consolidated the achievement of its subsidiary, W. Bryan Savage Ltd, and at the same time broadened the scope of its activities by bringing it into association with the great Ling Temco Vought Corporation of America to form a new Company, PYE-LING LIMITED. This organisation will produce a range of Vibration and Fatigue Testing equipment that will be unmatched throughout the world for comprehensiveness and quality. The resources and experience of both the Pye Group and Ling will ensure that the British Aircraft Industry will have immediately available the precise equipment it requires for the proving of every type of component.

The Liquid Cooled Vibrator illustrated has a Thrust Rating of 30,000 lb. and is the largest of a comprehensive range which starts at 25 lb.

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AP 12

evident and that noise and general feel were very realistic. During 360° turns wind effects were clearly evident and cyclic control had to be fully used to counteract them as the Heli-trainer turned. Everything helicopter-like was there, in fact, except the actual translational response to attitude changes and, of course, transition. But the trainer could realistically reproduce almost all that is difficult in helicopter flying—those exercises which take hours of wearing juggling at full power in a real machine before the basic co-ordinating habits are learnt. Stick forces, noise and feel were all quite realistic, although the noise from 20yd or so away was that of a well-silenced lawn-mower. The Heli-trainer costs 58,000DM in Germany (about £5,200) and can therefore offer very considerable savings for normal training.

I was also shown two films of the Cobra missile in production and in action. Bölkow are hopeful that Cobra might be adopted as a NATO infantry weapon because it is by far the lightest and cheapest weapon so far available and is already in production. Entac, Bölkow said, still exists only on paper. In addition to the orders noted above, Cobra has been evaluated by the US 7th Army and the US Marines; and a production licence has been granted to Daystrom Inc in the US. There seems to be a possibility that orders will come from the US services.

Cobra weighs 22lb at firing, has a normal range of between 400 and 1,800m and can by an average operator be turned as much as 65° off its initial firing line. It flies at 190 m.p.h. roll-stabilized by a single two-axis gyro, controlled by fluttering spoilers and guided by wires from a joystick and binoculars mounted on a very small control box. The warhead is connected to the missile only by its screw-thread attachment, contains its own acceleration-actuated arming device and a hollow charge capable of penetrating 24in of armour plate. Warheads can be rapidly interchanged in the field without tools and without modification to the missile. The 0.6sec boost motor is inclined at 22° to the missile body so that the Cobra makes a "jack-rabbit" start from the ground without a launcher. A cord is wound round the gyro spindle and the gyro spins-up to 12,000 r.p.m. under a 4.4lb pull during the actual launch, controls being locked by acceleration-sensitive device until the missile has reached a height of over 10ft and is aerodynamically stabilized. Carrying handle, clip-on battery and flare case are mounted along the top of the body and all fly with the missile.

Most of the structure is in plastics and the four-segment, sealed storage and transport case will float. It contains the warhead in a separate compartment and, in a sealed plastic bag, a 65ft reel of cable for remote firing, a small stake for anchoring the gyro-running cord and a small metal plate which forms a solid background and dust suppressor for the boost motor. Eight Cobras can be connected by their 65ft cables to a standard junction box and thence by additional cable to the firing box, which has an eight-position selector. Two Cobras, extension cables, firing box and junction box can be carried by one man over open ground and set up in under two minutes. Batteries of ten or six Cobras have been mounted respectively on the Italian and on US and German field cars, as well as on armoured troop carriers and other vehicles.

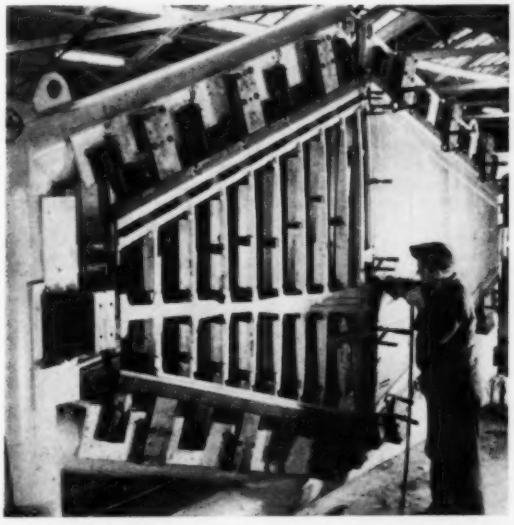
Additional Cobra equipment includes a very compact field test set for checking all electrical paths in the system and a battery-charging adapter. Finally a simulator, based on a modified domestic television tube, has been produced to give preliminary guidance training. Moving or intermittently visible targets, full range/speed and wind effect simulation are possible and the "missile" will stop if it is allowed to fly below the controller-to-target line of sight. The simulator consists only of a t.v. tube console and desk bearing control boxes for instructor and student. No special buildings or large target screens are needed. The German army training course lasts four weeks, but includes instruction in the tactical employment and maintenance of Cobra as well as in actual guidance. A US army team became proficient in firing in three days and then achieved about 75 per cent hits in range trials with moving tanks.

Ernst Heinkel Flugzeugbau

SOME six factories now form part of the Heinkel group and are responsible for the manufacture of the Heinkel scooter and for considerable sheet-metal working as well as aircraft production. Total works area is 3,920,000sq ft, of which 200,000sq ft are encompassed by the aircraft production factory at Speyer. Of the capital of 5,100,000 DM, some 74½ per cent is owned by Frau Lisel Heinkel and the remainder by Ernst Heinkel Motorenbau GmbH at Karlsruhe. More than 1,500 employees are engaged on aircraft work.

Within the Arbeitsgemeinschaften, Heinkel has completed the manufacture of part of the Fouga Magister and is now making the complete wing of the Fiat G.91 and the wing, fin and tailplane of

Above, adjusting the undercarriage in a G.91 wing panel made by Ernst Heinkel Flugzeugbau at Speyer



Above, an F-104G tailplane being made by Heinkel. Below, the cabin section of the Weser/Sikorsky S-64 crane, shown at the Paris Salon earlier this year

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the F-104G. The group also overhauls Marboré and Artouste engines for German Magisters and Alouette IIs, and Cessna L-19s for the US Army.

In the design field, Heinkel belongs to the Entwicklungsring Süd and has its own design offices in Munich. Shown for the first time at the Paris Salon earlier this year was the Heinkel development of the Fouga Magister, the Potez-Heinkel CM.191 four-seat executive jet and command transport. The first flight of this machine is expected during this autumn.

Weser Flugzeugbau

WITH 4,500 employees and four factories, Weser is the largest of the German airframe-manufacturing companies. Of its capital, 43 per cent is owned by United Aircraft and the remainder by Krupp. Main factories are at Lemwerder, near Bremen, and at Einswarden, near Bremerhaven at the mouth of the Weser river. Both factories have docks and a specially built, flat-topped powered lighter can transport large aircraft between the two works. Other factories are a well-equipped and modern jig and tool and machine works at Varel, south of Wilhelmshaven, and another smaller works at Hoykenkamp, near Delmenhorst. There is an airfield at Lemwerder and a heliport at Einswarden.

Weser produced many different types of aircraft in large numbers during World War II, specializing to some extent in marine aircraft. Now Weser is overhauling F-84Fs and RF-84Fs in large numbers for the German air force, has virtually completed licence construction of the centre wing, powerplants and tail booms of the Noratlas and is overhauling complete Noratlas for the Luftwaffe. A certain amount of electric, hydraulic, electronic equipment and instruments are being overhauled. Just coming to an end at Einswarden is the overhaul of US Army Sikorsky H-34s. Before the connection with Sikorsky was established, Weser had overhauled Vertol H-21s and the German H-34s are being overhauled by Henschel at Kassel. Incidentally, Henschel Flugzeug-Werke has a 40,000sq ft factory, 300 employees and a heliport, and overhauls both the H-34 and Alouette II for the German army. It also runs a spares sales service for the Alouette II and III.

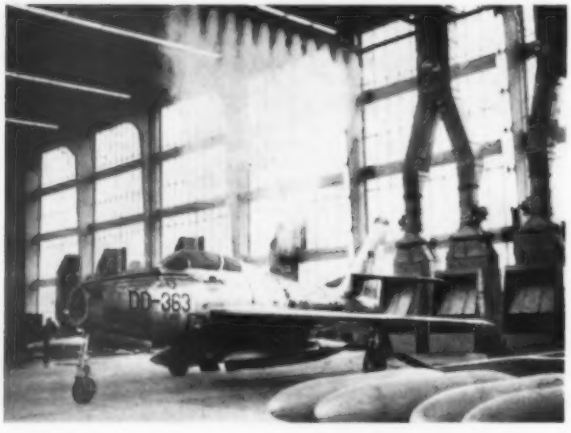
The Vertol agreement was subsequently transferred to Dornier and appears now to have passed to Westland in Britain. Weser "de-moth-balled" the F-84Fs when they originally were sent to Germany for the Luftwaffe. All overhaul work, except that of the H-34, is concentrated at Lemwerder, where there are extensive facilities for this type of work, including one of the most modern paint shops in Europe. A complete hangar, large enough to house several big aircraft at a time, has been "invisibly partitioned" with downward blowing air-curtains and extensive extractor fans so that several aircraft can be simultaneously painted in different colours. The various colours of paint are mixed in a basement and piped to taps on the hangar walls to which paint sprays can be directly attached. F-84F overhaul work is on an impressive assembly-line basis (see page 612).

Now, Weser is also taking part in the F-104G northern group, assembling centre-fuselages and equipping them. These are then sent to Aviolanda in Holland who install the remaining equipment, such as fuel tanks, mate the Weser centre section with the Hamburger forward fuselage and dispatch the unit to Fokker for final assembly and flight testing. The jigs are now being set up at Einswarden and the familiar process of progressive local production is under way. Einswarden, too, is the scene of the construction of the high-altitude research glider designed and made by Weser for the German ministry of transport. The machine bears a very slight resemblance to the Lockheed U-2, but Weser strongly deny any similarity between the operational roles of the two machines. The Weser glider is a two-seater intended to be able to climb to operational height under the power of a single P & W JT12. Its purpose is meteorological research. Extensive use has been made in the structure of Redux-bonded metal honeycomb, the entire webs and skins of the wing torsion-box being made in this way. A large Redux-bonding installation has been set up at Einswarden and a complete inner-wing skin panel was there at the time of my visit. Lying nearby was a 1 : 2.5 scale model of this skin intended for structural testing. Only one flying prototype has been ordered.

With a fair volume of work in hand in the factories, Weser is also determined to build up design capability. In 1956 the leading members of the Kurt Tank design team working on the Pulqui series of fighters in Argentina were brought back to Germany and Weser have also taken on part of the team which was developing Dr Focke's helicopter with Borg-Ward. Main design effort at the moment is the Transall, for which Weser are the co-ordinating and administrative authority. Einswarden is making the centre cargo section of the fuselage and has already delivered a floor section to Nord for the first prototype. Cabin side panels followed last week and subsequent sections for other flying and structural-test prototypes are well advanced. The construction programme is at the moment between four and six weeks behind schedule, but the first flight should be made at the end of next year or the beginning of 1963. The six pre-production aircraft should be delivered between the beginning of 1964 and the beginning of 1965. A large jig for the assembly of a complete fuselage is waiting at Einswarden to be used in the assembly of the first German flying prototype at Lemwerder. The third airframe is for static testing, for which a new installation is being built at Lemwerder; and the fourth airframe will be assembled and flown by Hamburger Flugzeugbau. The fifth and last of the prototypes will be sent to Toulouse for fatigue testing.

The principle is that the Transall is divided according to man-hours of work required equally between France and Germany; and the six pre-production machines will be built on this basis, possibly even being assembled individually by the three participating companies, each using components gathered together from the three manufacturers.

Franco-German co-operation has so far been going well. Each manufacturer receives drawings at 1 : 2.5 scale and enlarges them



Above, a Transall freight floor built by Weser at Einswarden and now delivered to Nord. Side panels are in jigs in the background. Below, coloured powder introduced to show the air-curtain in Weser's big paint shop at Lemwerder

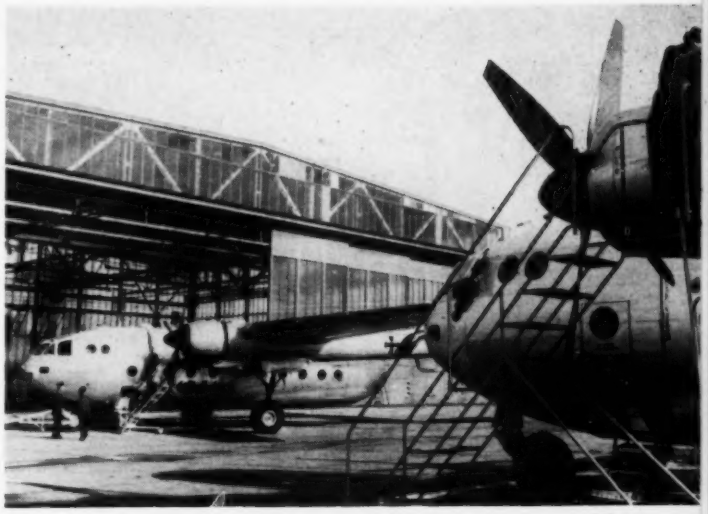
for lofting and other purposes. Jigs used for the prototypes are more massive than usual because interchangeability has to be ensured from the outset. Transall structure appears to be conventional, employing a certain number of large forgings and a little Redux-bonded lamination. All sub-assemblies are designed to be of a size to be carried in a standard railway freight wagon, but Weser will assemble their complete fuselage at Einswarden and transport it on the barge to Lemwerder.

Weser are seriously considering a civil version of the Transall as part of their attempt to enter the civil field. They are also considering fitting two turbojets under the wings to provide additional thrust for take-off, not for flap-blowing. The engines would be Rolls-Royce RB.145s and later RB.153s.

Another major aim of Weser is to enter the helicopter field, a logical step in view of the Sikorsky relationship. Weser designers have been in America for a year helping in the development of the WF-S-64 turbine-powered crane, a cockpit section of which was exhibited at Paris earlier this year. The crane is a German military programme, two prototypes having been ordered, but Weser also look to civil possibilities. A second German military helicopter programme is for a medium cargo machine, the choice now lying, according to Weser, between the Sikorsky S-61D, the Vertol Chinook and a developed Sud Super Frelon. Preference will probably be given to the Frelon, in the interests of European co-operation and standardization, but the final choice has not yet been made. Sud are in any case co-operating with Sikorsky in connection with Frelon transmission and Weser would ultimately be involved in production of either the S-61D or the Frelon. There is apparently a possibility that the Frelon will have Rolls-Royce engines.

Weser are actively interested in developing helicopters for medium-range passenger transport. They envisage a system of only three international airports for fixed-wing aircraft in Germany; internal and feeder traffic would all be taken by helicopter services There was also considerable scope for the simplification of transmissions and rotor systems for future helicopters.

Finally, Weser have joined the Entwicklungsring Nord to undertake joint development with Focke-Wulf and Hamburger Flugzeugbau. The company itself was not willing to discuss any projects the Ring might undertake, mainly because they said it had been so recently formed that there had hardly been time to begin constructive work.



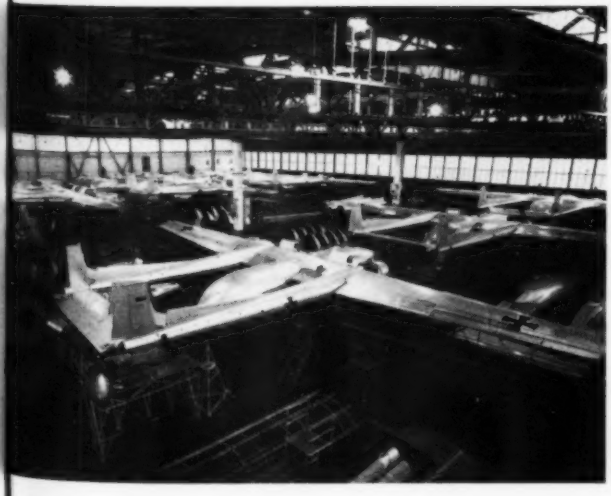
Noratlas overhaul still occupies considerable space at the Finkenwerder factory of Hamburger

Hamburger Flugzeugbau

FORMERLY a division of the great Blohm und Voss shipyards, Hamburger Flugzeugbau was re-formed after World War II as an independent company. It is based on the factory buildings and airfield beside the Elbe at Finkenwerder, which were, surprisingly, undamaged by wartime bombing. During the ten year hiatus the buildings were used as tank-repair workshops and all the original aircraft equipment was stripped and removed. Present floor area is 954,125sq ft and work force 2,500. A considerable complement of modern machine tools and equipment is installed.

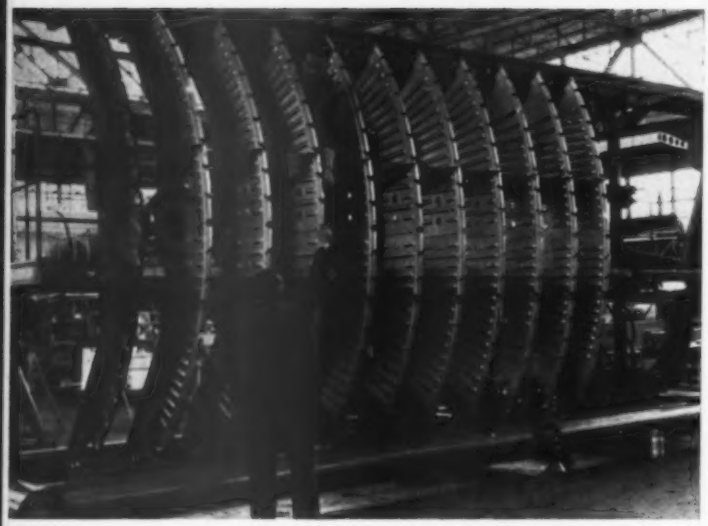
First post-war aircraft operation was the building, with the group of companies in Flugzeugbau Nord GmbH, of the Nord Noratlas under French licence. HFB made the fuselage and was responsible

Above, the Transall nose at Hamburger's Finkenwerder works. It is now fully skinned and extended some way rearward. Below, part of the Finkenwerder assembly halls in the Noratlas days



for final assembly and flight testing of all the 130 machines built. Weser and Siebel made the other components. When I visited the factory, the last Noratlas was in final inspection before making its first flight. Noratlas work is, however, by no means finished as the manufacturers are carrying out the various major periodic inspections and repair. Noratlas are now camouflaged, with the top of the fuselage painted white, and older silver machines are repainted as they come in for major overhaul. Also in evidence at Finkenwerder were numerous German air force C-47s being fitted with new radio and electronic equipment. Pembrokes and Herons are being similarly equipped; and the Convairs used as government VIP transports were converted here.

Both at Finkenwerder and at their second factory at Stade, some 35 miles distant, HFB are now getting under way their part of the North group production of the F-104G. Both at Finkenwerder and Stade, lines of jigs are taking shape and the first sub-assemblies made up from Lockheed-made parts are being completed. As I reached Stade, the first half-shell of a forward fuselage was being crated for transport to Finkenwerder, where internal equipment would be added. HFB is making the forward fuselage complete, but also making certain unequipped portions of the centre-fuselage which are then sent to Bremen for incorporation in the Weser assembly. F-104G work in the northern companies is at a much earlier stage than in the south. HFB are working for the first time in inches, as opposed to metric measurements, and are in



Transall rear fuselage top section in jigs at Hamburger's Finkenwerder factory. Noratlas overhaul is under way in the background

Tourist class airline seats awaiting completion and delivery at the Stade factory of Hamburger Flugzeugbau

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the process of making their production jigs from master jigs and patterns supplied from Burbank. Individual pieces are still sent from Lockheed, but German detail parts will be progressively incorporated. This is probably the most difficult stage of all in the licence production procedure.

The capacity of HFB is by no means fully taken up with licence production. Since the company was re-formed it has been building up a design team, and systematically trained personnel from shop-floor to design-engineering level. Three years ago, HFB was able to propose to the German Government two new transports, the HFB 219 turboprop and the HFB 314 short-range jet transport. Although the design capacity was there, government financial support was essential if these projects were to get under way. But the government did not provide the necessary assistance. HFB continued to work until Boeing announced the 727. After this, the HFB 314 was abandoned.

In the meantime, design and manufacture of airliner seats was taken up and HFB seats have been supplied for Lufthansa Viscounts and Super Constellations and for South African Airways and others. HFB are tendering for the Lufthansa Boeing 727 seating. The Stade factory is responsible for seat production and a batch of them is shown in col 1.

A major design and production venture is, of course, the Transporter Allianz C.160 Transall, during the early stages of which HFB submitted a complete design study of their own. For the C.160 itself, HFB are designing and making the forward fuselage and tapered aft-fuselage section for all the companies concerned. They will also assemble and fly one of the three prototypes themselves. Altogether, five sets of components are needed, three for the flying prototypes and two for static testing. It has been generally reported that orders have recently been confirmed for a pre-production batch of six Transalls.

HFB have joined in the formation of the Entwicklungsring Nord, which has been formed as joint design centre for new projects of various types. It has been reported, although the companies themselves were either unwilling or unable to confirm it, that ER Nord will design an STOL or VTOL transport to NATO Military Basic Requirement 4. At all events, the Ring has only just been formed and the first meetings were only recently held. A good deal of administrative work still remains to be done before the Ring can start constructive design work at a specific headquarters.

For the present, the prospects for HFB are good. They have completed the first licence-building stage successfully and are taking the first and most difficult hurdles in the F-104 programme. But they have also built up a reasonably strong design team over a period of years and are eager to develop their own aircraft. During the development period, whether it be solely an HFB venture or through participation in the Ring, the F-104 and Transall programmes will provide factory work and considerable additional experience.

Focke-Wulf

AFTER a brilliant pre-1945 history of aircraft design under Prof Kurt Tank, Focke-Wulf began building gliders in 1951 and then made the Piaggio P.149D trainer under licence. They also started hydraulics and plastics departments and made the two prototypes of the Blume Bl502. The P.149D, Sea Hawk, Gannet and Grumman Albatross are being overhauled. Focke-Wulf are joining in the North Group of companies making the F-104G. They provide the engine access-door with the central hydraulic installation mounted on it, and the intakes and air ducts.

In 1960 Focke-Wulf signed an agreement with SNECMA for further development of the Coléoptère and at the Paris Salon this year a multi-engined lift pod for a transport aircraft was exhibited. Now, Focke-Wulf have begun to co-operate closely with Hawker Aircraft at Kingston for the development of a VTOL fighter.

The factory is at Bremen airport and most of the 3,000,000 DM capital (about £270,000) is held by Standard-Elektrik Lorenz and Böttscherstrasse GmbH. Employees number about 1,000 and factory floor area is 42,600sq ft.

MARK LAMBERT

This jig for the side panels of the tapering Transall tail is now well filled at Finkenwerder

GERMAN INDUSTRY DIRECTORY

The companies listed below are members or associate members of the Bundesverband der Deutschen Luft- und Raumfahrt Industrie, the association which is equivalent in Germany to the Society of British Aircraft Constructors. The list was provided by the BDLI.

AEG Allgemeine Elektricitätsgesellschaft,
Frankfurt/Main-Süd 10, AEG-Hochhaus.
Aluminium-Walzwerke Singen GmbH,
Singen/Hohentwiel.
Aluminiumwerke Nürnberg GmbH,
Nürnberg, Nopitschstrasse 67.
Apparatebau Gauting GmbH,
Gauting bei München, Ammerseestrasse 31.
Bergische Stahlindustrie,
Remscheid, Papenberger Strasse 38.
Prof. Dipl.-Ing. W. Blume, Leichtbau u. Flugtechnik GmbH,
Duisburg-Ruhrort, Tausendfensterhaus.
BMW Triebwerkbau GmbH,
München 68, Dachauer Strasse 665.
Bodenseewerk Perkin-Elmer & Co GmbH,
Überlingen/Bodensee.
Bölkow-Entwicklungen KG,
Ottobrunn bei München.
Robert Bosch GmbH,
Stuttgart W, Breitscheidstrasse 4.
Continental Gummiwerke AG,
Hannover, Continental-Haus.
Daimler-Benz AG,
Stuttgart-Untertürkheim, Postfach 77/80.
Deutsche Dunlop Gummi Compagnie AG,
Hanau/Main.
Deutsche Edelstahlwerke AG,
Krefeld, Oberschlesienstrasse 16.
Deutscher Aeroexpress GmbH, Luftwerft und Flugdienst,
Hamburg-Fuhlsbüttel, Flughafen.
Dornier-Werke GmbH,
Friedrichshafen.
Dornier-Reparaturwerft GmbH, Oberpfaffenhofen,
München-Neuaubing, Brunhamstrasse 21.
Drägerwerk, Heinr. & Bernhard Dräger,
Lübeck, Moislinger Allee 53-55.
J. Eberspächer,
Esslingen/Neckar, Eberspächerstrasse 24.
Kurt Eichweber,
Hamburg-Altona, Schützenstrasse 77-79.
Elektron-Co GmbH,
Stuttgart-Bad Cannstatt, Glockenstrasse 36-38.
Julius & August Erbslöh, Aluminium-Walz- und Presswerke,
Wuppertal-Barmen, Berliner Strasse.
Focke-Wulf GmbH,
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Frankfurter Maschinenbau AG, vorm. Pokorny & Wittekind,
Frankfurt/Main-West, Solmsstrasse 2-26.
Otto Fuchs KG Metallwerke,
Meinerzhagen/Westfalen.
Glasurit-Werke M. Winkelmann AG,
Hamburg 1, Postfach 988.
Goetzewerke, Friedrich Goetze AG,
Burscheid bei Köln.
Hamburger Flugzeugbau GmbH,
Hamburg-Finkenwerder, Kreetslag 10.
Wilhelm Harting, Werk fur Elektrotechnik und Mechanik,
Espelkamp/Mittwald, Kreis Lübbecke/Westfalen, Marienburger Strasse.
Ernst Heinkel AG,
Stuttgart-Zuffenhausen, Hellmuth-Hirth-Strasse 41.
Ernst Heinkel Flugzeugbau GmbH,
Speyer, Am neuen Rheinhafen 10.
Henschel Flugzeugwerke AG,
Kassel, Henschelstrasse 2.
Herbig-Haarhaus AG, Lackfabrik,
Köln-Bickendorf.
Junkers Flugzeug- und Motorenwerke AG,
München 13, Franz-Joseph-Strasse 1.
Klöckner-Humboldt-Deutz AG,
Köln-Deutz, Deutz-Mülheimer Strasse 149-155.
Fried. Krupp,
Essen, Altendorfer Strasse 103.
Kugelfischer Georg Schäfer & Co.,
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Luther-Werke, Luther & Jordan,
Braunschweig, Frankfurter Strasse 249-255.
MAN Turbomotoren GmbH,
München 68, Dachauer Strasse 667.
Merckle Flugzeugwerke GmbH,
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Messerschmitt AG,
Augsburg, Postfach 322.
Messerschmitt & Co. KG,
München 25, Tölzer Strasse 40.
Osnabrücker Kupfer- und Drahtwerke,
Osnabrück.
Dr.-Ing. e. h. Alfred Pierburg KG,
Neuss/Rhein, Düsseldorfer Strasse 232.
Rhein-Flugzeugbau GmbH,
Krefeld-Uerdingen, Arndtstrasse 60.
Röder-Präzision,
Frankfurt/Main, Hanauer Landstrasse 155.
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Siebelwerke-ATG GmbH,
Donauwörth, Industriestrasse 4.
Siemens & Halske AG,
München 2, Wittelsbacherplatz 2.
Siemens-Schuckert-Werke AG,
Erlangen, Werner-von-Siemens-Strasse 50.
SKF Kugellagerfabriken GmbH,
Schweinfurt.
Stahlwerke Sudwestfalen AG,
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Telefunken GmbH,
Berlin-Charlottenburg 1, Ernst-Reuter-Platz.
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Frankfurt/Main, Rebstöcker Strasse 41-53.
VDO Tachometer-Werke Adolf Schindling GmbH,
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Westfälische Leichtmetallwerke GmbH,
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Ulm/Donau, Olgastrasse 147.
Gebr. Winkelsträter GmbH, Maschinenfabrik,
Wuppertal-Barmen, Postschliessfach 2048
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Hirzenhain/Oberhessen.

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Wuppertal-Barmen.
Hoffmann & Co GmbH, Propellerwerk,
Rosenheim/Obb., Küpferlingstrasse 15.
Honsel-Werke AG,
Meschede/Westfalen.
Ilo-Werke GmbH, Kleinverbrennungskraftmaschinen,
Pinneberg bei Hamburg.
Kloth-Senking AG, Eisen- und Metallgiesserei,
Hildesheim, Cheruskerring 38.
Richard Kohnke, Fallschirmwerk,
Heidelberg-Ziegelhausen, Heinrich-Stoess-Strasse 31.
Walter Kosteletzky KG,
Weingarten/Württ., Am Hallersberg.
Dr. Meleghy KG, Fabrik fur Werkzeugbau,
Bergisch-Gladbach/Köln, Dombach.
Techno-Chemie Kessler & Co GmbH,
Frankfurt/Main-West 13, Voltastrasse 71-75.
Trossinger Metallstimmenfabrik Hans Eisen,
Trossingen/Württ., Breite Strasse 29.
Turco-Chemie GmbH,
Hamburg 24, Postfach Nr. 3233.
Vofa-Werk, Xavier Vorbrüggen,
Düsseldorf/Oberkassel, Lörickerstrasse 106.
Wotan-Werke GmbH, Werkzeugmaschinenfabrik,
Düsseldorf-Holthausen, Reisholzer Werftstrasse 76.
Robert Zapp,
Düsseldorf, Zapp-Haus, Bleichstrasse 8-10.

LIGHT AIRCRAFT MANUFACTURERS WHO ARE NOT MEMBERS OF THE BDLI

Alfons Putzer KG,
Bonn, Bornheimerstrasse 133.
Scheibe Flugzeugbau GmbH,
Dachau, nr Munich, August Pfalz-Strasse 23.
Stark Flugzeugbau GmbH,
Minden, Kaiserstrasse 9-11.

The Lockheed F-104G and Canadair CF-104 will soon become a familiar sight in every part of Western Europe. The majority will wear the black-and-white of the Luftwaffe

LARGEST AIRCRAFT-PRODUCTION PROGRAMME IN THE WORLD

Super Starfighter

IN many respects, the Lockheed F-104 Starfighter surpasses every other type of aeroplane. In speed, ceiling, rate of climb, acceleration, and most other aspects of pure performance it has few rivals. Perhaps no other military aeroplane can touch it for sheer glamour. Apart from research machines, it is generally regarded as being the "hottest" vehicle which pilots have ever been asked to handle, and arguments regarding its safety—and effectiveness—have waxed loud and long. Today this neatly engineered, razor-edged storm centre has become the subject of the biggest aircraft-manufacturing programme in the world, and probably the greatest example of international co-operation on a technical level that the world has yet seen. In fact, it is doubtful if any manufactured article has ever been the subject of so much effort in so many countries.

This journal examined the genesis and design of the F-104 on April 20, 1956, and again on May 30, 1958, when we presented the first detailed cutaway drawing of the F-104A ever published. In this issue, in which the keynote is the resurgence of the Federal Republic of Germany as a leader in aircraft manufacture, we offer an appraisal of the aeroplane which is costing that country more money than all other types put together. The F-104G Super Starfighter differs considerably from the less-capable earlier versions, and this article traces its development, and outlines the world-wide network of manufacturers who are helping each other to make it.

Outwardly, the Super Starfighter differs only slightly from its predecessors, giving little clue to its very great increase in operational effectiveness and versatility. In contrast, the original design team at the California Division of Lockheed Aircraft examined a remarkable diversity of studies when the project began during the Korean war. Shortcomings of the first generation of US Air Force jet fighters led to a requirement for a "day superiority fighter," in which everything was subordinated to flight performance. Arranged in strips on these pages may be seen a selection of the ideas which "Kelly" Johnson's men thought might provide the answer.

In March 1952 work began on the model 227-0-6, with sliding intake centrebody, and on the 227-0-11. The latter was the true ancestor of the F-104, but the delta wing and flush cockpit were soon abandoned. In April the design grew to 30,000lb, but by July the 227-16-2 reversed the trend. This aircraft weighed only 8,000lb, and it introduced an amazing unswept wing, of only 16ft 9in span and a t/c ratio of only 3.6 per cent, which became standard for all subsequent projects. Apart, that is, from the 227-14-1, with tail booms mounted at the tips of the wing. A strange idea in August was the tiny (15ft 8in span), rocket-propelled 227-15-3, which suffered from inadequate range. In contrast, the 227-13-1 was the result of a vicious circle which raised the weight to approximately 50,000lb.

By October a real effort had been made to reduce size and weight, and the smaller engine of the 227-20-1 reduced the weight to 25,000lb without affecting range and performance. Lockheed went further, and the 242-19-1 represented an unsuccessful attempt to slash the weight to 9,000lb (at the same time introducing a vee windshield and low tailplane, together with elementary area ruling). The 242-23-1 represented an attempt to reduce frontal area by hiding fuel and landing gear behind the air ducts, but its performance was poor at speeds above the transonic regime. A much more successful approach was the 246-1-1, of 22ft 1in span. Lockheed still did not like the vee windshield (feeling that a flat screen was necessary for gun-sighting); the intakes had to be changed, and the horizontal tail was raised to the top of the fin to eliminate inertia coupling. The 242-1-27 was an attempt at reducing length by retracting the main gears into nacelles, but this had many disadvantages. The final drawing on page 623 represents an empty weight of about 12,000lb, and is almost the XF-104 which was finally built.

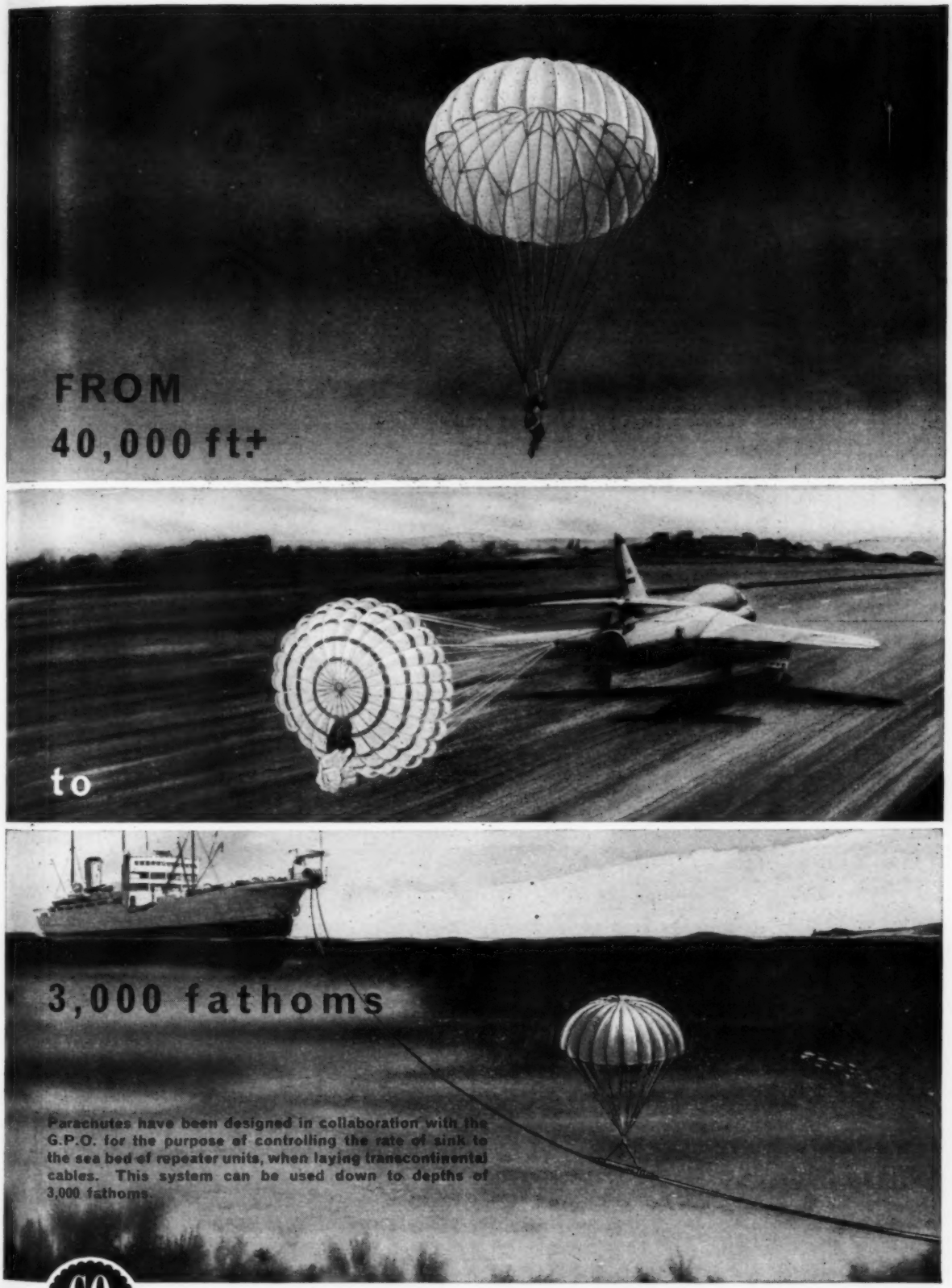
After further refinement, the XF-104 was then designed, built and flown in less than a year. Development then continued, and the production F-104A differed in having a larger engine (General Electric J79 with afterburner) fed by a fixed-geometry, multi-shock intake with cleverly arranged bleed systems to match airflow requirements to the flight regime. To accommodate the larger engine and increased fuel capacity the fuselage was lengthened by several feet, and other major changes included a switch to an a.c. electrical system of much enhanced capacity, and the addition of a search and track radar system, armament and a ventral fin.

Lockheed manufactured fewer than 300 F-104 Starfighters for the US Air Force. The first production machine was the single-seat F-104A day fighter for Air Defense Command, which entered operational service in January 1958. The F-104B is a tandem-seat trainer/air-defence model for the same command, the F-104C is a single-seat attack/ground-support version for Tactical Air Command, and the F-104D is a tandem-seat trainer/local-defence variant for Tactical Air Command. Squadrons equipped with the F-104A found that the good qualities of the aircraft were marred both by limited operational effectiveness and by a safety record which compared unfavourably with that of other "Century-series" aircraft. Today this version of the Starfighter is no longer in US service, except as the QF-104 target drone. The F-104C incorporates such major improvements as flap-blowing, a retractable flight-refuelling probe and provision for carrying a range of stores externally. Several more advanced versions have since been offered to the US Air Force, but none has been accepted.

In 1958 Lockheed prepared proposals for three advanced versions embodying improvements to the structure, systems and equipment, under the company designations F-104-7 (TAC fighter/bomber), -9 (NATO/US air superiority) and -11 (ADC advanced air superiority). The company appreciated that they would have to conduct an extensive redesign in order to produce a multi-mission aircraft capable of competing successfully with the many other aircraft then becoming available in the same category. Moreover, they began to look increasingly outside the United States to find a market.

From 1956 Lockheed and the US Air Force subjected the F-104 to a test programme involving 52 test aircraft flying approximately 8,000 missions for a programme cost somewhat in excess of $30m. One of the many conclusions drawn was that the airframe would have to be redesigned if the role of the aircraft were to be changed from day superiority fighter to all-weather fighter/bomber. But Lockheed knew there would be little chance of selling a purely defensive aircraft, and accordingly the company themselves undertook the development of what is virtually a new aeroplane.

The entire structure was re-stressed to meet fighter/bomber strength requirements with full external loads, and to permit ground-support and penetration missions to be accomplished at low altitudes with no placard restrictions. A total of 36 new forgings was introduced for such major components as wing fittings and spars, fuselage frames, longerons and joint-members, and spars and


FROM
40,000 ft.+
to
3,000 fathoms
Parachutes have been designed in collaboration with the G.P.O. for the purpose of controlling the rate of sink to the sea bed of repeater units, when laying transcontinental cables. This system can be used down to depths of 3,000 fathoms.

G. Q. PARACHUTE COMPANY LIMITED

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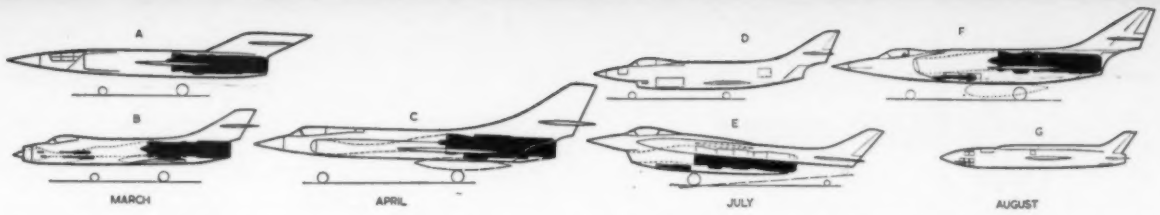
£1,200,000 EXPORT CONTRACT FOR NEW COMPANY

Formed only two months ago, by Napier, English Electric and Rolls-Royce, Napier Aero Engines Limited have already obtained an order worth one million, two hundred thousand pounds. They are to supply Gazelle free-turbine engines for 27 new Westland Wessex Mk. 31 Helicopters for the Royal Australian Navy – together with spares and support equipment.

NAPIER AERO ENGINES LTD

ROLLS-ROYCE – ENGLISH ELECTRIC · 211 THE VALE · ACTON · LONDON · W3



Stages in the evolution of the F-104: A, Model 227-0-11; B, 227-0-6; C, 227-8-1; D, 227-16-2; E, 227-14-1; F, 227-13-1; G, 227-15-3. All drawings on this page have been prepared to the same scale, emphasizing the variation in size between projects. For dates, see text

ribs in the tail unit. Approximately 60 lesser forgings are of the zero-draught close-tolerance variety, which the company estimates has saved approximately 40 per cent of the cost of conventional machined parts.

To provide the increased control power required for operations at low altitudes and increased gross weights, modifications were made to the tail unit. The principal change represents a refinement of the enlarged vertical tail originally developed to counteract the increased side area of the tandem-seat nose of the F-104B. Lockheed extended the leading edge of the fin forwards, incorporated irreversible hydraulic power to drive the rudder and eliminated the separate yaw-damper tab previously fitted. At the same time, the hydraulic boost system for the horizontal tail was appreciably increased in power.

Modifications were made to improve the performance of the wing. Chief among these is an alteration to the control system governing the trailing-edge flaps, to enable the latter to be employed as manœuvring flaps. Lockheed claim that their use "results in as much as 33 per cent reduction in airplane turn radius at an altitude of 5,000ft." These flaps are fully blown, and for take-off and landing are supplemented by the full-span leading-edge flap. The latter is machined from a slab of 7075-T6, and the leading-edge radius is so sharp (0.016in) that felt protective guards are frequently employed during maintenance operations. The ailerons are hung on 90-ton-steel piano hinges and driven by hydraulic manifolds serving ten parallel actuating rods.

Logical modifications to the landing gear included fully powered brakes with an anti-skid system energized by sensing units in the axle of each wheel. At the same time, the diameter of the braking parachute was increased from 16ft to 18ft, and Lockheed briefly investigated the practicability of fitting an arrester hook. It was decided to add electro-thermal de-icing elements to the engine intakes, and the choice fell upon the British Spraymat, produced under Napier licence by Pacific Airmotive Corporation. To increase range during purely offensive operations, provision was made to replace the six-barrel M61 gun and ammunition bay by an aluminium fuel tank with a capacity of 120 US gal.

What the F-104G Can Carry

Modifications of this nature were all largely decreed by the decision to turn the aircraft into an attack vehicle with the ability to carry a wide range of external stores. Most important of these are the "Special Weapons"—the euphemistic term for nuclear bombs—many types of which can be hung from Station 3 on the aircraft centreline. Ten feet away, the wing-tip shoe can carry a Sidewinder air-to-air missile or a tank with a capacity of 170 US gal (see photograph, page 622). Stations 2 and 4, beneath the wings, can each carry a 195 US gal tank, an air-to-surface missile (the F-104 has yet to be seen with such a weapon, but the Bullpup and possibly a modified Nord AS.30 come to mind as possible loads), and a great variety of other stores up to a unit weight of 1,000lb. A similar range of stores, as well as a pair of Sidewinders or a 225 US-gal tank, can be hung on Station 3 already mentioned.

In parallel with these extensive airframe modifications Lockheed sketched a very complete system for internal and external armament. The only internal armament of the earlier models was the General Electric M61 "Vulcan" six-barrel gun, with a single-belt feed, installed in the lower port side of the forward fuselage. This was retained, but modified in detail to increase rate of fire to the theoretical 6,000 rds/min: and electric drive was standardized.

The question of all-weather radar, fire control, weapon-delivery systems, navigation and instrumentation was far more complex. Lockheed were fortunate in that a major nation, with a potential requirement for a very large number of aircraft, had since mid-1957 been giving the Lockheed proposals far more than a cursory examination. This nation was the Federal Republic of Germany.

During 1958 German engineers co-operated with Lockheed in developing a model appropriately called the F-104G. If anything, this was to be an even more advanced aeroplane than the F-104-7 already planned. It was soon clear that its operational equipment and maximum external load would raise the overload weight to at least 20,000lb, and it is a remarkable fact that the resulting aircraft has the same wing and powerplant as the earlier versions.

After an evaluation of "nearly two dozen of the world's top fighter aircraft," the Federal Government in Bonn announced their choice of the F-104G as their future standard tactical aircraft in February 1959. Lockheed have described how the painstaking and protracted evaluation of the large team from the Luftwaffe and Herr Strauss's Defence Ministry gradually narrowed the list of US designs down to two aircraft. The other machine was clearly the Grumman G-98 Super Tiger, powered by the same engine as the F-104. It had the advantage of being a *fait accompli*, whereas the F-104G was then almost two years distant. But Lockheed claim to have eliminated their rival by a series of competitive performance trials, using an existing F-104C.

Still in the race were one or two European aircraft—in particular, the Mirage III. In retrospect, there are strong grounds for feeling that this aircraft would have met the requirements of the Luftwaffe fully as well as the F-104, but it succumbed to Lockheed's brilliant salesmanship. At that time neither aircraft existed as a developed weapon, but Lockheed were more convincing in describing the equipment which they were going to fit. It is probably fair to suggest that something also depended upon the image created by the respective companies: Lockheed presented a bold, confident and united front; Dassault were a much smaller team, with practically no experience of making presentations of such a character. Moreover, the French company's cause can hardly have been assisted by reluctance on Dassault's part to turn their sleek intercepter into a pylon-festooned attack aircraft.

Long before the deal was clinched, Lockheed had evolved a comprehensive specification, and it is appropriate to outline the operational equipment specified for the F-104G before going on to analyse its remarkable success. Many details remain classified, but the basic principles have already been outlined by Lockheed.

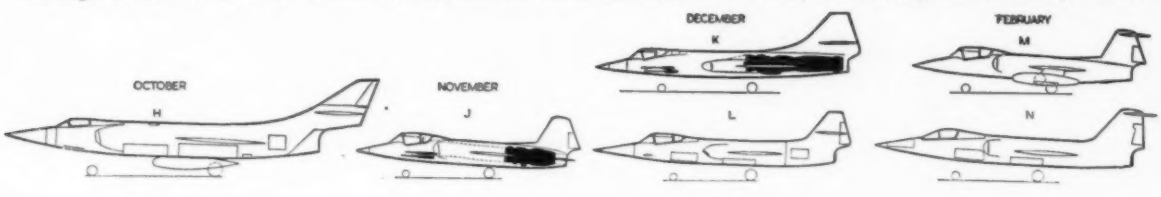
It is in its electronic features that the F-104G differs principally from the versions of the F-104 ordered by the US Air Force. For the USAF the F-104 is an air-superiority weapon, whereas for European military requirements it needs to perform as an all-weather intercepter, fighter/bomber or reconnaissance aircraft.

One of the most important new electronic systems is the multi-purpose NASARR F-15A radar, by NAA Autonetics Division. Consisting of a radar set and a fire-control computer, the equipment operates in two basic modes—air-to-ground for bombing and navigation, and air-to-air for target interception—and is capable of providing data-link information read-out. For air-to-ground operation it provides ranging information for bombing computation in visual bombing modes, ground mapping for all-weather bombing, contour mapping for navigation and terrain avoidance. In air-to-air use it provides increased power for radar search, acquisition and automatic tracking of air targets to achieve the capability for: lead-collision attack for automatic release of rockets; lead-pursuit attacks using the M61 gun, with information supplied to director-type gunsight; and pursuit attack with Sidewinder guided weapons.

Another important "black-box" is the air-data computer, which

(*Continued on page 626, after double-page drawing*)

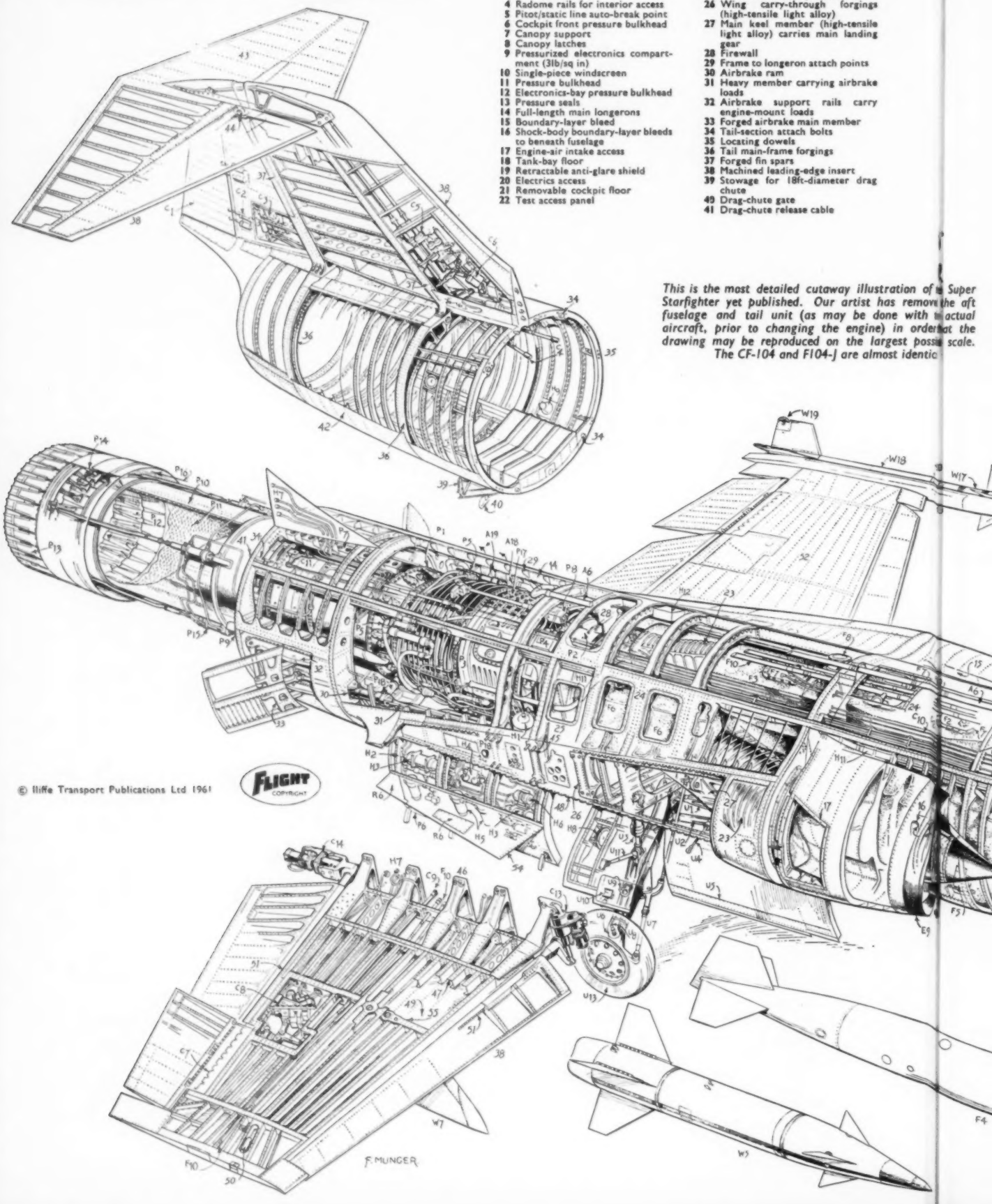
Final stages in the evolution of the design: H, 227-20-1; J, 242-19-1; K, 242-23-1; L, 246-1-1; M, 242-27-1; N, a design which is virtually the XF-104



Super Starfighter . . .

Structure
1 Pitot/static probe
2 Spun glass-fibre radome
3 Radome latches
4 Radome rails for interior access
5 Pitot/static line auto-break point
6 Cockpit front pressure bulkhead
7 Canopy support
8 Canopy latches
9 Pressurized electronics compartment (3lb/sq in)
10 Single-piece windscreen
11 Pressure bulkhead
12 Electronics-bay pressure bulkhead
13 Pressure seals
14 Full-length main longerons
15 Boundary-layer bleed
16 Shock-body boundary-layer bleeds to beneath fuselage
17 Engine-air intake access
18 Tank-bay floor
19 Retractable anti-glare shield
20 Electrics access
21 Removable cockpit floor
22 Test access panel
23 Extruded light-alloy engine air duct
24 Fuel-tank access
25 Control and fuel system access
26 Wing carry-through forgings (high-tensile light alloy)
27 Main keel member (high-tensile light alloy) carries main landing gear
28 Firewall
29 Frame to longeron attach points
30 Airbrake ram
31 Heavy member carrying airbrake loads
32 Airbrake support rails carry engine-mount loads
33 Forged airbrake main member
34 Tail-section attach bolts
35 Locating dowels
36 Tail main-frame forgings
37 Forged fin spars
38 Machined leading-edge insert
39 Stowage for 18ft-diameter drag chute
40 Drag-chute gate
41 Drag-chute release cable

This is the most detailed cutaway illustration of the Super Starfighter yet published. Our artist has removed the aft fuselage and tail unit (as may be done with the actual aircraft, prior to changing the engine) in order that the drawing may be reproduced on the largest possible scale. The CF-104 and F104-J are almost identical



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42 Steel and titanium skin on tail section
43 Tailplane, 3.6in thick root, 0.6in thick tip
44 Tailplane hinge-pin
45 Wing-root attach bolts
46 Wing-root forgings
47 Channel-section stiffeners
48 Root-fairing attachment
49 Machined skin 0.25in root, 0.125in tip
50 Tip-tank latch and solenoid
51 Piano hinge on underside
52 Wing, 3.6 per cent thick, 10° anhedral
53 Missile mounting shoe
54 Ventral fin
55 Stores-pylon mounting rib

A Air systems
A1 Liquid-oxygen converter (5-litre)
A2 Ram-air intake (refrigeration system, and electronics emergency cooling)
A3 Ram-air to refrigeration system
A4 Water boiler
A5 Cold-air unit
A6 Engine bleed air from primary heat-exchanger (213°C, 250lb/sq in)
A7 Secondary heat exchanger
A8 Defrosting-air delivery
A9 Cabin-air delivery
A10 Fan exhaust to gun-bay purging
A11 Venturi
A12 Flow-control valve
A13 Mixing chamber
A14 Pressure-altitude switch
A15 Hot-air exhaust
A16 Water separator
A17 Temperature-control valve
A18 Primary heat-exchanger
A19 Primary heat-exchanger air outlet
A20 Conditioned-air outlet to cockpit (—4°C)
A21 Defrosting-air ducts
A22 Radar-cooling air outlet

C Controls
C1 Rudder piano-hinge on port side
C2 Rudder power units
C3 Rudder power-unit control valves
C4 Rudder and elevator control rods
C5 Tailplane power unit
C6 Tailplane power-unit control valves
C7 Aileron 10-cylinder power unit
C8 Aileron power-unit control valves
C9 Aileron control rod
C10 Control cable runs port and starboard
C11 Control lever, cable to rod, to C4
C12 Control-cable duct
C13 Leading-edge-flap actuator
C14 Main-flap actuator
C15 Power-control lever
C16 Control column
C17 Column pivot on aileron torque-tube
C18 Elevator push/pull rod
C19 Elevator torque-tube and levers
C20 Toe-brake linkage
C21 Port and starboard consoles, provision for changeable panels
C22 Controls support and centring device
C23 Elevator cables
C24 Bell-crank group port and starboard
C25 Control rigging-pin access
C26 Angle-of-attack vane

E Emergency
E1 Canopy jettison hinge/latches
E2 Martin-Baker Mk Q5 ejection seat
E3 Ejector firing handles
E4 Canopy external release
E5 Emergency cold air inlet
E6 Ram-air turbine
E7 Alternator (5kVA)
E8 Hydraulic pump
E9 Spraymat anti-icing

F Fuel
F1 Auxiliary tank
F2 Forward main tank
F3 Aft main tank
F4 100 gal drop tank (fuel fed by air pressure)
F5 3-phase, high-voltage boost pumps (4 off)
F6 Saddle tanks
F7 Inspection plate and tank anchorage
F8 Fillers (standard total cap with tip tanks 1,400 gal +)
F9 Optional flight-refuelling probe
F10 Vent and feed pipes

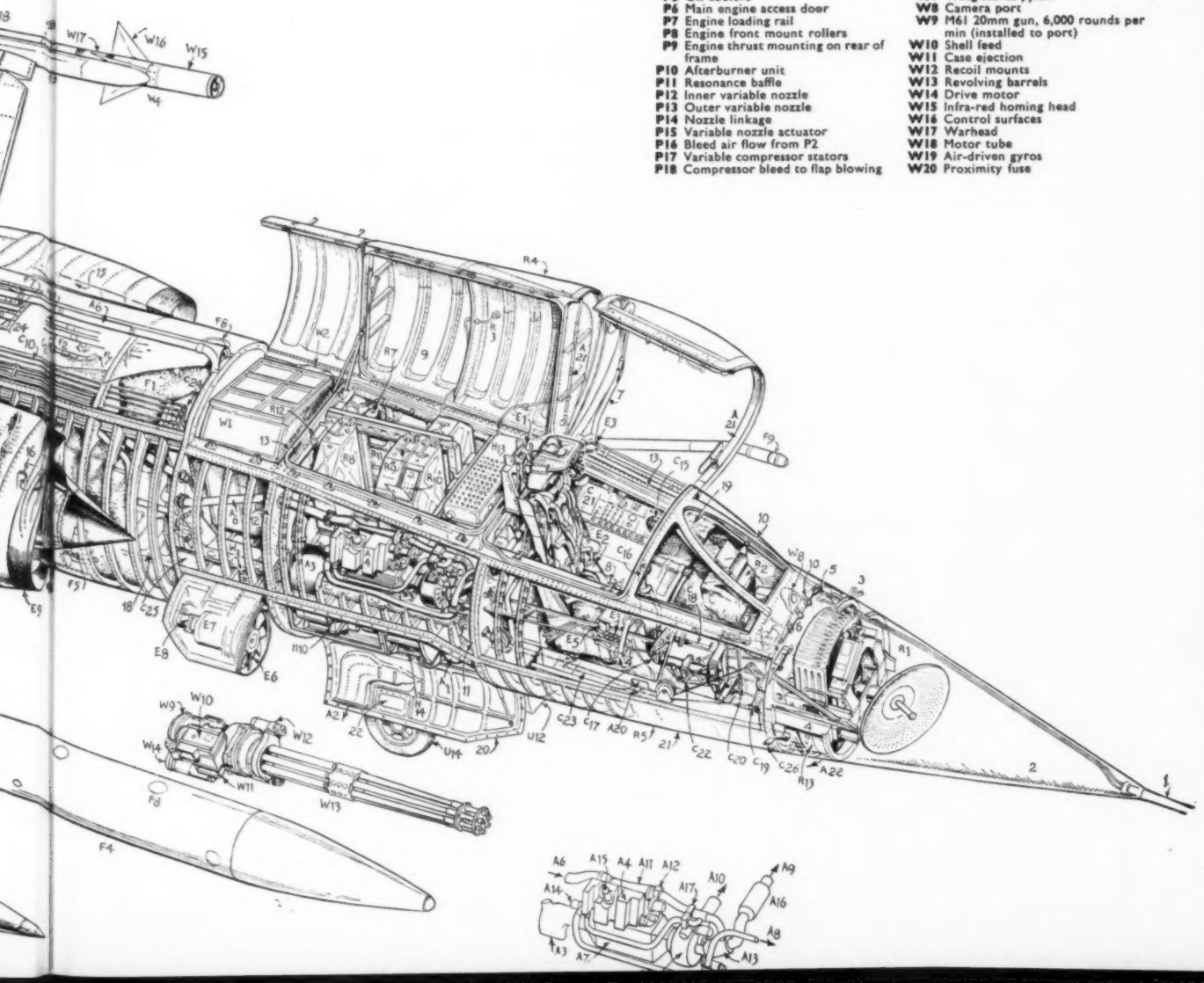
H Hydraulic and electric power
H1 Hydraulic reservoir
H2 Hydraulic servicing panel on door
H3 Hydraulic accumulators (two 3,000lb systems)
H4 Pressure gauges
H5 Pressure filters
H6 Pressure transmitters
H7 Hydraulic pipe runs to actuators
H8 Taxi lamp
H9 Navigation lights
H10 High-voltage electrics bay
H11 Cable duct (port and starboard)
H12 Junction box
H13 Circuit breakers
H14 Batteries (2-28V)

P Powerplant
P1 General Electric J79 GE-7 engine
P2 Engine-air bypass bleed flaps
P3 Oil tank
P4 High-energy ignition units
P5 Oil coolers
P6 Main engine access door
P7 Engine loading rail
P8 Engine front mount rollers
P9 Engine thrust mounting on rear of frame
P10 Afterburner unit
P11 Resonance baffle
P12 Inner variable nozzle
P13 Outer variable nozzle
P14 Nozzle linkage
P15 Variable nozzle actuator
P16 Bleed air flow from P2
P17 Variable compressor stators
P18 Compressor bleed to flap blowing

R Radar and electronics
R1 NASARR type R22-A radar (range and lead, for gunsight, missile computer and fire-control computer, target information and ground mapping)
R2 Infra-red optical sight
R3 Aerial lead-in
R4 Aerial in canopy moulding
R5 UHF/ADF aerial in cockpit floor
R6 Aerials
R7 Compass, inertial navigation and fire control, on port side
R8 Interchangeable "jeep can" electronics packages
R9 "Jeep can" latches
R10 Individual test panels
R11 Cooling air supply through rack
R12 Flexible rack-mounting
R13 Radar test panel

U Undercarriage
U1 Link, supporting jack end
U2 Retraction jack
U3 Dowty Liquid Spring unit
U4 Preclosing door jack
U5 Preclosing doors
U6 Wheel-swivel joint
U7 Wheel-swivel linkage
U8 Brake pipe
U9 Towing point
U10 Up latch
U11 Door link
U12 Nose-gear door
U13 High pressure mainwheel tyres
U14 Forward-retracting nose-gear

W Weapons
W1 Ammunition pack
W2 Feed to gun
W3 Ammunition hoist pick-up
W4 Sidewinder air-to-air missile
W5 Bullpup air-to-ground missile
W6 External stores rack under fuselage
W7 Wing stores pylon
W8 Camera port
W9 M61 20mm gun, 6,000 rounds per min (installed to port)
W10 Shell feed
W11 Case ejection
W12 Recoil mounts
W13 Revolving barrels
W14 Drive motor
W15 Infra-red homing head
W16 Control surfaces
W17 Warhead
W18 Motor tube
W19 Air-driven gyros
W20 Proximity fuse



Super Starfighter . . .

receives electrical analogues of pitot and static pressure, air temperature and angle of attack from remotely located transducers. It transforms this information into the various functions of altitude, airspeed, Mach number, rates of change, and angle of attack required by other computers in the aircraft.

Navigation is assisted by a lightweight Litton inertial system, which measures actual ground distance and track, and is in no way dependent upon forecast or computed winds. It has a high degree of accuracy, and continuously presents to the pilot position by latitude and longitude. Presentation is made through the PHI (Position and Homing Indicator), a miniature automatic navigator which works on the principle of dead-reckoning. Developed by Computing Devices of Canada, the PHI computes by remembering where it started and keeping track of all course changes and speeds. The pilot has a choice of five pushbuttons, each marked with the name of a target or destination. Pushing any button causes the pilot's indicator to show him the heading to fly to reach that destination, and the distance to go in nautical miles.

The F-104G's bombing computer, which ties in with the inertial navigator, air-data computer and NASARR systems, mechanizes the relationship between the bomb trajectory and the aircraft in space. As a result of this mechanization, bomb release takes place at the proper point in space to impact on the target. There are four basic bomb delivery modes: dive-toss, LABS (low-altitude bombing system), over-the-shoulder and level release.

Complete provisions are made for installation of a data line-time division set. This equipment provides a means of receiving course direction (automatically computed at the ground environment) towards an enemy aircraft until acquisition is made by airborne radar. It has many advantages; it provides back-up voice service to the primary u.h.f. command set; can be used in either an air-defence or ground-support environment; gives the pilot a visual display of the intercept situation; allows full utilization of the autopilot; provides for a "return to base" operation; eliminates language barriers which normally accompany voice operation; provides for memory of the latest received information; permits selective addressing; is nearly invulnerable to jamming; and pinpoints target information on the NASARR indicator.

TACAN is standard in the F-104G. This is a radio air-navigation system of the polar co-ordinate type, which provides the aircraft with instantaneous and continuous information on distance (in n.m.) and direction (in degrees of bearing) from a ground station.

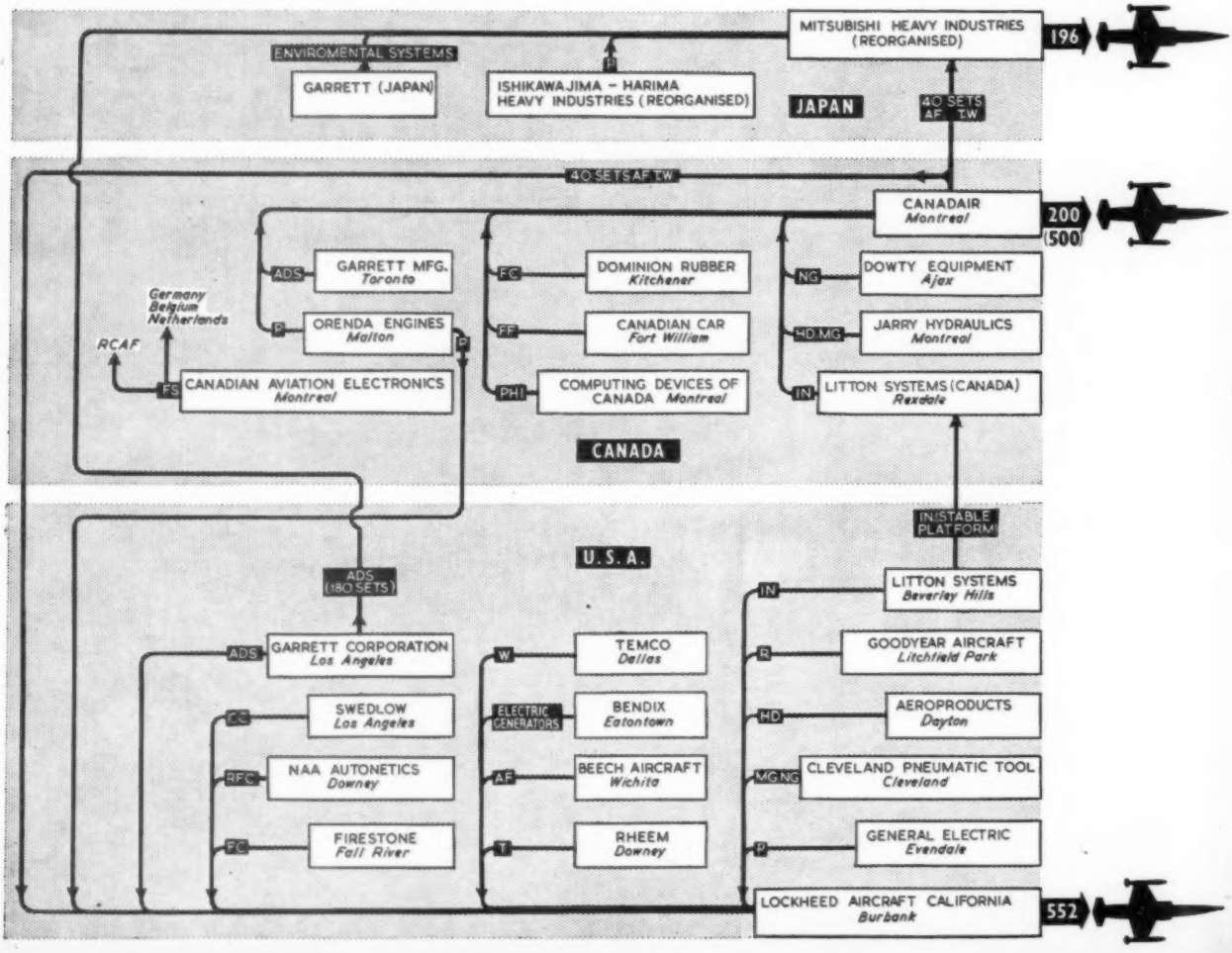
The European F-104G has a director-type gunsight. This presents to the pilot an optical indication of the line of sight with the proper lead angle for firing the M61 gun. When caged, the sight is used as an aiming reference for firing Sidewinders in a pursuit attack. When used with an infra-red sight these capabilities may be accomplished at night, as well as during daylight hours. Additionally, the caged sight reticule may be used as an aiming reference for visual dive-bombing.

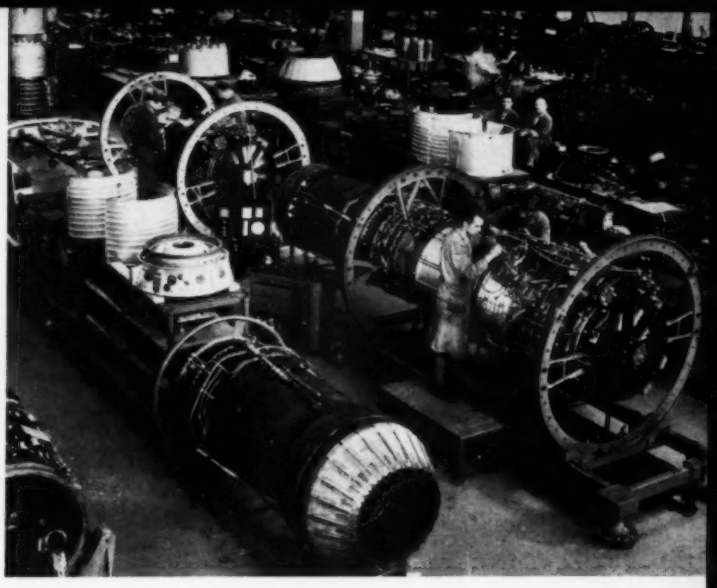
Advantages of the director sight (over the disturbed-reticle sight fitted to USAF F-104s) include: smaller sight head, resulting in better pilot visibility through the windshield; improved tracking; lighter weight; no separate computer required in electronics compartment, thereby permitting installation of other necessary electronic equipment; and easier installation and maintenance. For compatibility with the director-type sight, the new infra-red sight will offer daytime capability and improved detection range. It will be integrated with the director sight, and utilizes a common optical system.

Key to Components Symbols in Diagrams Below

A, autopilot; AB, airbrake; AD, air ducts; ADS, air-data system; AF, aft fuselage; AI, air intakes; AID, air-intake de-icing; CC, cockpit canopy; DF, dorsal fairing; EH, electronics hatches; ES, ejection seat; FB, fuselage bulkheads; FC, fuel cells; FF, forward fuselage; FH, fuel tank hatches; FS, flight simulator; HD, hydraulics door; IN, inertial navigation system; IS, infra-red sight; K, keel pieces; LE, loose equipment; LO, liquid-oxygen system; MF, mid-fuselage; MG, main landing gear; MGD, main-gear doors; N, nose; NG, nose gear; NGD, nose-gear doors; O, optical sight; P, powerplant; R, radome; RC, range computer; RFC, radar fire control; T, tail unit; TN, Tacan navigation system; TT, tip tanks; UT, underwing tanks; W, wings; WS, windscreen.

The family tree below is inevitably incomplete, particularly in respect of Japanese production; but it is the best that can at present be achieved. The flow of components from Lockheed and Canadair will be noted, but it is impossible to show the huge quantities of drawings, jigs and such items as special forgings or instruments which are not yet available outside North America. A key to symbols used appears above





Powerplant of the F-104G is the 15,800lb-thrust J79-11A, designed by General Electric's Large Jet Engine Department near Cincinnati. These examples are in the BMW factory at Munich, and other engines are being made by FN, Alfa Romeo and Ishikawajima-Harima

F-104 WORLD-WIDE

THE remainder of this account is a condensed survey of the countries associated with the F-104, arranged in alphabetical order.

Belgium Less prosperous than West Germany, Belgium is said to have chosen the F-104 largely on economic grounds. She is a member of the Western industrial group formed for F-104G manufacture, the genesis of these groups being given in the section dealing with Germany. The agreement forming the Western Group was signed by Belgium, Germany, Italy and the Netherlands in December, 1960. Despite difficult conditions created by loss of the Congo, unrest at home and severe criticism by the Socialist group in the Chamber of Representatives, Belgium's part in the programme is now firm. Avions Fairey and SABCA are establishing a joint production line and flight-test facility at Gosselies, near Charleroi, for the manufacture of 164 aircraft, and a further 30 will be erected from parts supplied by Fiat. Allocation of the aircraft is given in the table on the left. Tooling is well advanced, the first aircraft is due to be completed next September and the scheduled output of six aircraft per month should be reached by the beginning of 1963.

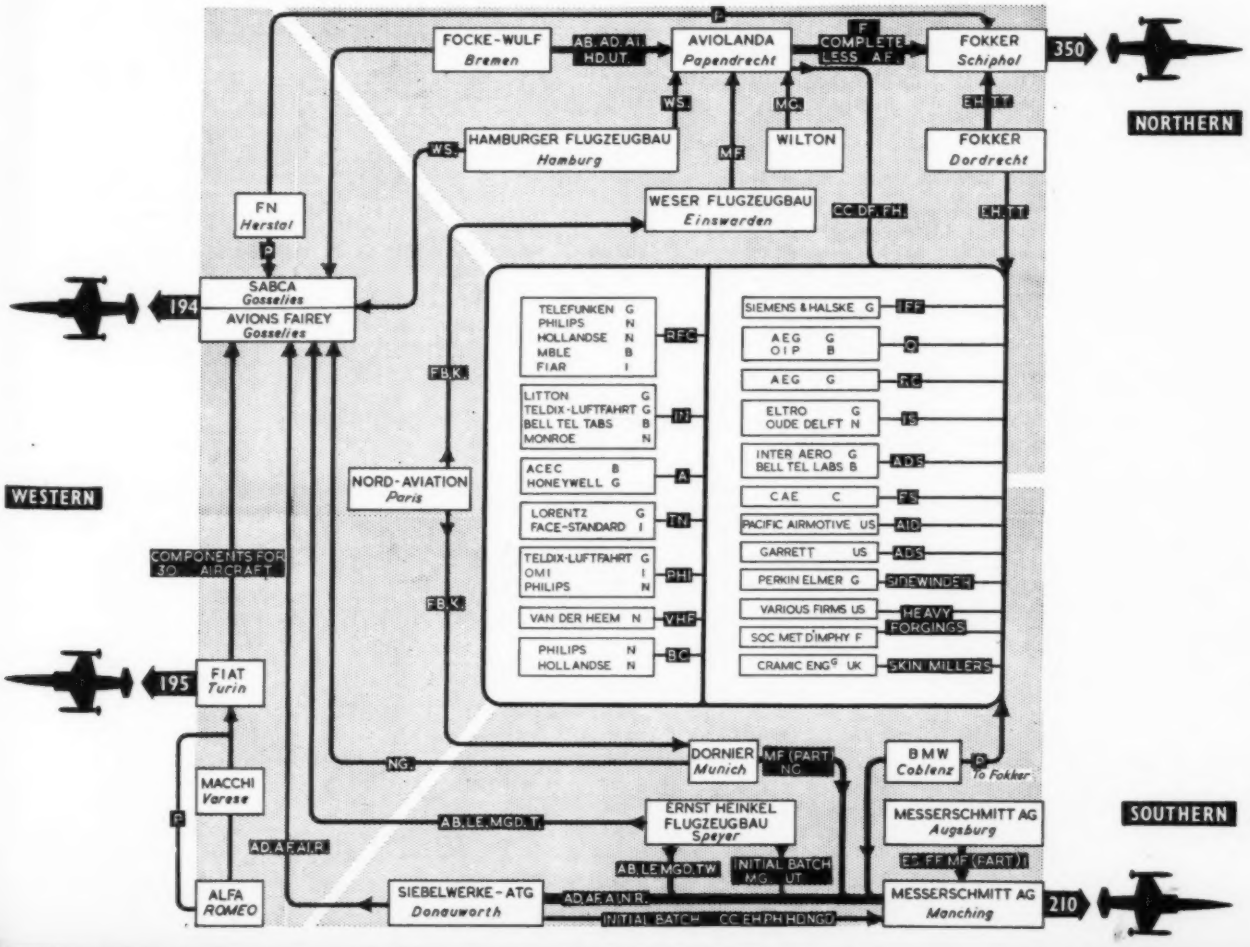
SIZE OF THE PROGRAMME

Source	USAF	Germany	Belgium	Netherlands	Italy	Canada	Japan	Other NATO	Total
Lockheed	295 A, B, C, D	30 F, 96 G, 54 TF-G	—	20 TF-G	—	14 CF-D	3 J, 1 DJ	39 G	552
ARGE Nord	—	255 G	—	95 G	—	—	—	—	350
ARGE Sud	—	210 G	—	—	—	—	—	—	210
Fairey/SABCA	—	89 G	75 G	—	—	—	—	—	164
Fiat	—	50 G	25 G	25 G	125 G	—	—	—	225
Canadair	—	—	—	—	—	200 CF	—	300 *	500
Mitsubishi	—	—	—	—	—	—	177 J, 19 DJ	—	196
Total a/c	295	784	100	135	125	214	200	?	2,197
Cost ($ × 10⁶)	?	1,130	160	173	198	383	270	?	?

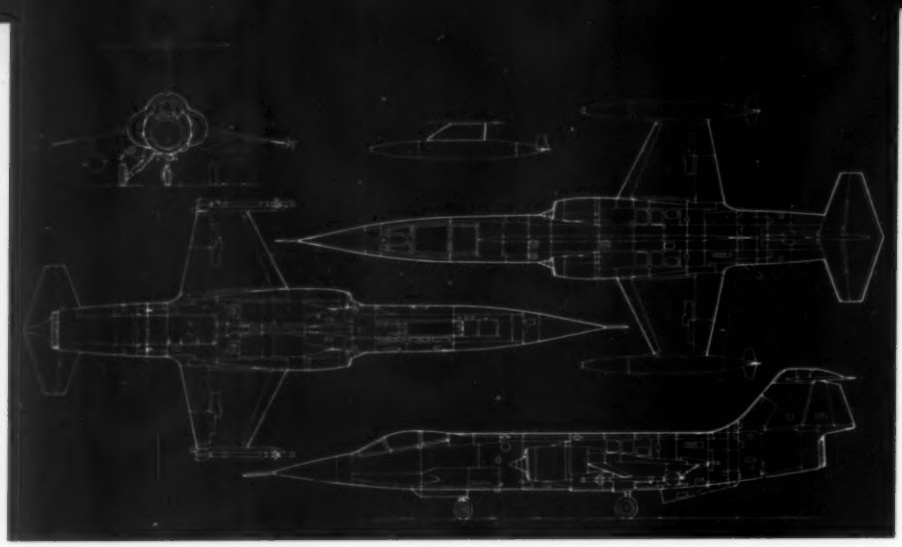
* This is the maximum size of a possible MDAP contract now being discussed.

Canada Selection of the F-104G for the RCAF Air Division assigned to NATO in Europe was announced in July 1959, and on

Below is a portrayal of the vast European programme. In the central rectangle are arranged those firms making what might be termed "systems," and a key to the lettering employed appears above. The totals of aircraft produced are those which will actually roll out from the factories concerned. Fiat will ship parts for 30 aircraft to Belgium, so that true manufacturing totals from each source are as given in the table above



Super Starfighter . . .



This drawing was prepared by Canadair Ltd. Although the subject is the CF-104, the European F-104G is externally identical. Data include: span, 21ft 11in; length, 54ft 9in; height, 13ft 6in; gross weight, 20,000lb

August 1 of that year it was stated that Canadair Ltd. would be prime contractor for the 200 aircraft necessary. The manufacturer's designation is CL-90; the RCAF nomenclature for the aircraft was originally CF-111, but this was changed to CF-104 for obvious reasons. Compared with the F-104G, the Canadian aircraft differs in minor respects, reflecting the fact that its primary mission is ground attack. It has a different optical sight, and an R-22-A or R-24-A search and ranging radar system. The first CF-104 was rolled out on schedule on March 27, and about a dozen have now flown. Canadair is shipping 121 sets of wings, aft fuselages and tails to Belgium, Germany and the Netherlands, 40 sets to Lockheed, 40 sets to Japan and large numbers of sub-assemblies to subcontractors. Moreover, political considerations may mean that a large batch (up to 300) of special MDAP aircraft for Turkey, Greece, Denmark, Spain and other NATO countries, will be manufactured by Canadair.

Germany From the outset, Germany decided that she was not going to buy aircraft but make them, and a great deal of thought went into the licence-agreement signed in March 1959 between the Federal Government and Lockheed. This licence served as a model for the five others which have since been signed, and the US magazine *Business Week* estimates that "Lockheed is getting up to 15 per cent in royalty fees." To handle production an all-German consortium was created, initially called the *Arbeitsgemeinschaft* but soon renamed the *Arbeitsgemeinschaft Sud* (South Group). The formation can be seen from the diagram on page 627, and it is gratifying to note that Arge Sud have always been responsible for the manufacture of 210 aircraft; every other European group has had its programme changed, sometimes more than once. When the Netherlands chose the F-104, Arge Nord (North Group) was formed and the total number of aircraft allocated to it has varied from 364 through 375, "400 or thereabouts" to a presumed finalized total of 350. The leader of this group is Dutch, but it includes all the major airframe companies in Northern Germany.

Italy Latest nation to join the 104 circus, Italy is using virtually the entire resources of her aircraft industry to manufacture 225 aircraft, 30 of which will be assembled in Belgium. Representatives of the many firms involved met at the Milan offices of the Associazione Industrie Aeromissilistiche last February.

Japan Having cut their teeth with the F-86F, Mitsubishi have been assigned the huge task of making 177 F-104Js, which are virtually identical to the European F-104G. The first 29 are being shipped in "knocked-down" form from Lockheed California; in fact, the first three have actually been flown at Palmdale before being dismantled for shipment. The first aircraft is due to be assembled and delivered to the Japanese Air Self Defence Force next March, and the following month supply of the 29 built from American components will begin. Next year 51 aircraft are due to be delivered, and the total of 180 fighters and 20 F-104DJ trainers —one of which will be flown by Lockheed—should have been delivered before January 31, 1965.

Netherlands Largest of the European manufacturing groups is Arge Nord, and the leader of the group is Fokker. As in the case of the other groups, work was divided on a basis of man-hours—percentages are: Fokker, 33; Aviolanda, 17; Hamburger, 23; Focke-Wulf, 9; and Weserflug, 18—and all work is on a fixed-price basis. Fokker have had to build a large nine-storey building solely to handle electronics and data-processing, together with laboratories for checking out equipment received from suppliers, a line-support section and calibration laboratory. The whole of the Arge Nord is now actually making components, although the first five aircraft are being assembled from components shipped by Lockheed or Canadair, followed by 15 aircraft supplied in the form of small components to the Arge Nord subcontractors. The first F-104G should roll out from Schiphol next month, the first aircraft wholly manufactured within the group is timed for July next year, and the scheduled rate of production from next March onwards is to be 40 aircraft per quarter.

USA Little need be added to the information given in the diagrams and tables. It is worth noting, however, that in a recent progress report to Lockheed stockholders, some interesting financial figures were given. It was stated that the nations participating in the F-104 programme would spend $1,000m with US industry. "Out of this amount," said Lockheed, "the US Government will contribute in direct support the total of $220m. So that, at a time when the reverse flow of US gold is of primary concern, the US balance of trade will show a net gain of $780m." Big business indeed; but the greatest value of the programme is probably less tangible. In a world in which there is a conscious awareness of the need to erode national boundaries, no other single undertaking seems to offer such promise of speeding this end, nor to pose a sterner test.

Although the first Canadair CF-104 was shipped to Palmdale, California, for its first flight, all CF-104s are now flown at the manufacturer's plant near Montreal. This pleasing study shows the braking parachute fully deployed during a landing by a Canadair test pilot

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THE GERMAN INDUSTRY

Aircraft, Engines, Missiles

A REVIEW OF CURRENT TYPES

BOLKOW-APPARATEBAU GMBH, Ottobrunn Bei Munchen

Bölkow F.207 (1961 Model) A development of the Bölkow-Klemm Kl107 series, the F.207 is a four-seater with a Lycoming O-360 engine of 180 h.p., driving a Hartzell constant-speed propeller. As a two-seater the aircraft can be used for training or for "utility" applications and, with the pilot alone, for aerobatics. Glider-towing equipment, or a combined ski-wheel undercarriage, can be supplied on request. A *de luxe* version has, in addition to the standard VFR panel, a gyro-compass and an artificial horizon, as well as radio and radio-navigation equipment in various combinations.

Span, 35ft 6in; length, 27ft 2in; weight empty, 1,538lb; gross weight, 2,640lb; max. cruising speed, 146 m.p.h.; range, 810 miles.

Bölkow Junior In our report of the Paris Show earlier this year we described this fascinating little aeroplane as "the most exciting light aircraft at Paris, if not in Europe." A side-by-side two-seater, it is of all-metal construction and is powered with a Continental O-200-A engine of 100 h.p. Essential features are evident in the photograph. The cabin is as wide as that of a Cessna 150, but the shoulder wing, with cutaway root, gives full visibility.

Span, 24ft 4in; length, 18ft 5in; weight empty, 688lb; gross weight, 1,200lb; cruising speed (75 per cent power), 136 m.p.h.; range, 560 miles. (*Bölkow Agents in Great Britain are Flair-Aviation Sales Co, Tower House, College Road, Bromley, Kent.*)

Further references to Bölkow aircraft will be found on page 616.

DORNIER-WERKE GMBH, Brunhamstrasse 21, Neuaubing, Near Munich

Do27 A notably successful STOL aircraft, the Do27 seats from six to eight persons and is powered with a Lycoming GO-480-B1 A6 engine of 270 h.p., driving a Hartzell constant-speed propeller. The wing has a full-span fixed slat and the flaps and ailerons are double-slotted. A seaplane version is available and another alternative undercarriage is a wheel-ski gear, the skis being hydraulically retractable. The makers list the applications of the Do27 as passenger or cargo transport, crop spraying, photography, ambulance and rescue work, glider towing and various military roles.

Span, 39ft 4in; length, 31ft 6in; weight equipped 2,490lb; gross weight, 4,080lb; cruising speed (75 per cent power at 6,000ft), 130 m.p.h.; range (without reserves), 840 miles.

Do28 Though having the same seating capacity as the Do27 (six to eight) this aircraft is twin-engined, having two Lycomings of 250 h.p. each driving, as on the single-engined aircraft, Hartzell constant-speed propellers. Extracts from an air test report printed in our May 4, 1961, issue read: "The Do28 is really a twin-engined IFR version of the Do27 and the two aircraft are noticeably similar to handle. An aileron wheel replaces the plain stick and the panel has been filled up with IFR instruments, miniature engine gauges and small radios, for which there is just enough room beneath the enormous combined door and windscreen panels. The Do28 wing is larger and tankage greater, the fin is altered and the Lycoming O-540 250 h.p. engines are outrigged in that distinctive way, but the cabin and general arrangement are otherwise the same as in the Do27. The Do28 twin includes one radio and the IFR equipment as standard, and sells for DM210,000 (£16,550) in Germany . . .

"Perhaps most gratifying of all was that low-speed performance was little affected by loss of an engine. At 45kt, with one propeller windmilling and not feathered, I was quite happy with the nose pointing at the clouds and the ground behind my back. For airline purposes, this means that full advantage can be taken of short take-off performance while meeting engine-out safety requirements."

Span, 45ft 3in; length, 29ft 8in; weight equipped, 3,680lb; gross weight, 5,400lb; cruising speed (75 per cent power), 160 m.p.h.; range (without reserves at 60 per cent power), 650 miles; take-off run (zero wind), 600ft.

Do29 Purely experimental, the Do29 is serving for the investigation of special STOL/VTOL problems and various powerplant configurations. It is a modification of the Do27 and the two Lycoming engines drive pusher propellers through shafts which can be inclined to provide a vertical thrust component.

Above, Bölkow Junior

Right, Bölkow F.207

THE GERMAN INDUSTRY . . .

Noratlas

Fiat G.91 R3 Assembly and testing of this tactical reconnaissance and strike aircraft is Dornier's responsibility. Also heavily committed in the programme are Heinkel and Messerschmitt. The G.91 R3 is similar to the G.91 R1 for the Italian Air Force but armed with two 30mm guns instead of four of 12.7mm. There are four pylons below the wings for offensive loads or extra tanks. Provision is made in the nose for four reconnaissance cameras and standard equipment includes Doppler radar and Computing Devices of Canada PHI navigation computer. In addition to the Bristol Siddeley 803 turbojet a notable item of British equipment is the Martin-Baker Mk 4 fully automatic ejector seat.

Span, 38ft 1in; length, 34ft 2in; gross weight, 11,350lb approx.; max. speed, 650 m.p.h. approx.

HAMBURGER FLUGZEUGBAU GMBH, Kreetslag 10, Hamburg-Finkenwerder

Nord 2501 Noratlas Together with the Weser and Siebel concerns Hamburger are responsible for the Noratlas transport programme. Their primary responsibilities are final assembly and flight testing. Powered by two SNECMA (Bristol Siddeley licence) Hercules of 2,040 h.p. each, the Noratlas has rear-loading facilities and a cargo capacity of 1,800cu ft.

Span, 106ft 7in; length 72ft; gross weight, over 46,000lb; cruising speed 208 m.p.h. approx.

ERNST HEINKEL FLUGZEUGBAU GMBH, Speyer Am Rhein

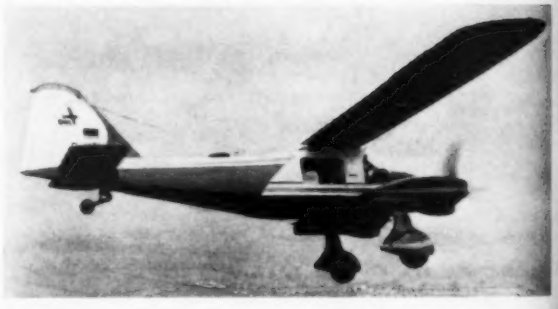
Potez-Heinkel CM.191 This four-seater twin-jet touring, training and liaison aircraft has been developed from the Fouga Magister CM.170 trainer, as produced very extensively in France, Germany and elsewhere. We reported on the occasion of the Paris Show: "Under the sliding canopy there is reasonable room for four comfortable seats and the cabin is pressurized at 9,000ft so that oxygen is not necessary. Instruments (including two full blind-flying panels) are well arranged, with a battery of electrical switches, Lear ADF-102 and ARC-34 UHF across the lower edge of the panel. Controls are well distributed, systems being basically the same as those of the Magister, on which most of the airframe is based. . . . Cost of a 191 with basic instruments is DM900,000 (£81,000) and deliveries are to begin in 1962."

Span, 39ft 9in; length, 32ft 7in; weight empty, 4,865lb; gross weight, 9,405lb; max. cruising speed 410 m.p.h.; max. range, 1,318 miles.

MERCKLE FLUGZEUGWERKE GMBH, Bad Friedrichshall-Oedhelm/Wurtt

SM 67 Now undergoing flight trials is a helicopter of the foregoing designation, powered by a Turboméca Artouste 2C gas turbine rated at about 490 h.p. Basically the SM 67 is a five-seater built along the lines of the French Sud Alouette. Empty weight is about 2,300lb, gross weight about 3,750lb and cruising speed 118 m.p.h.

Dornier Do27



Dornier Do28

Above, Fiat G.91

Potez-Heinkel CM.191

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From Rome to the gold-rich Rand. Alitalia's long-range DC-8's, powered by Rolls-Royce Conway engines, cover in hours distances that took the overland trekkers months. Pre-war pioneers of 'bush pilot' operations in Africa, Alitalia now operate in 41 countries, providing a network of 93,000 route miles reaching almost around the world. At both ends of Alitalia's trans-African service it is AIR BP who provide the fuelling service: at Fiumicino by the latest highly efficient hydrant system, at Johannesburg by tankers capable of delivering thousands of gallons in a matter of minutes.

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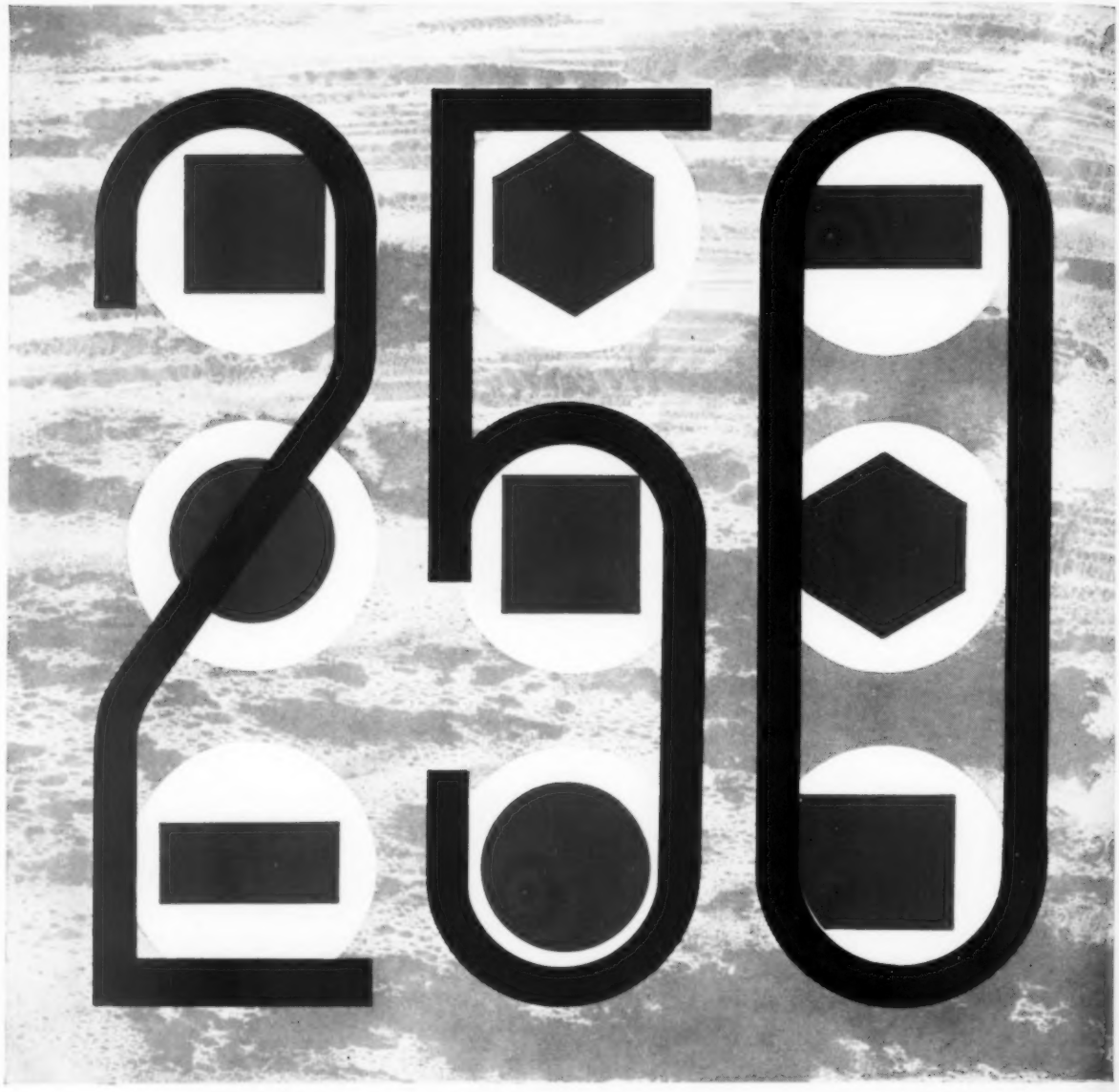

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THE GERMAN INDUSTRY . . .

makers recommend one of the Continental engines; for glider towing the Lycoming is more suitable. The following data apply to the SF-23C:

Span, 32ft 6in; length, 20ft 5in; weight empty, 1,058lb; gross weight, 1,610lb; cruising speed (60 per cent power), 105 m.p.h.; take-off distance to 50ft, 460yd.

Motorspatz-1 This is a single-seat powered glider, powered with a Brändl ZB300S engine of 23 h.p. Span is 46ft; max speed, 80 m.p.h.; and ceiling 9,850ft.

Scheibe Sailplanes The following types of sailplane are offered: *Zugvogel-IIIA* (single-seat high-performance); *Zugvogel-IVA* (single-seat high-performance, with wing of shorter span); *L-Spatz-55* (single-seater for training and competition flying); and *Bergfalke-II/55* (two-seater for training and competition flying).

ALFONS PUTZER KG., Bornheimer Strasse 133, Bonn

Elster Powered with a Continental C90-12F engine of 90 h.p., the Elster seats pilot and passenger side-by-side in a cabin having upward-hingeing doors. The fuselage is of plywood monocoque construction.

Span, 43ft 4in; length, 23ft 3in; weight empty, 1,015lb; gross weight, 1,545lb; cruising speed, 93 m.p.h.; range, 280 miles approx.

(*British agents for the Elster are: Flair-Aviation Sales Co, Tower House, College Road, Bromley, Kent.*)

RHEIN-FLUGZEUGBAU GMBH, Krefeld-Uerdingen

RF-1 An executive aircraft of uncommon interest, the RF-1 has already flown. Installed in the wings are two Lycoming O-540-A1A engines, each of 250 h.p. These drive a Hartzell propeller, located aft of the cabin in a "ring wing," designed to increase lift and thrust. There are six seats, and cabin access appears uncommonly easy. Plastics are extensively used for the structure.

Span, 43ft 10in; length, 42ft 10in; weight empty, 3,970lb; gross weight, 5,955lb; typical cruising speed, 160 m.p.h.; take-off distance at gross weight, 500ft approx.

RW-3 Passat This is the latest development of the Porsche-powered Multoplan pusher and was exhibited at the Paris Show earlier this year. The engine is a Lycoming O-320 of 150 h.p. and refinements include an electrically retractable undercarriage, hydraulic brakes, all-metal rear fuselage, and adjustable seats. Wing extensions (15ft each) can be readily fitted for flying at 21,000ft, glider towing or gliding at 1 : 26.

Gross weight, 2,200lb; cruising speed, 155 m.p.h.; endurance, 4hr.

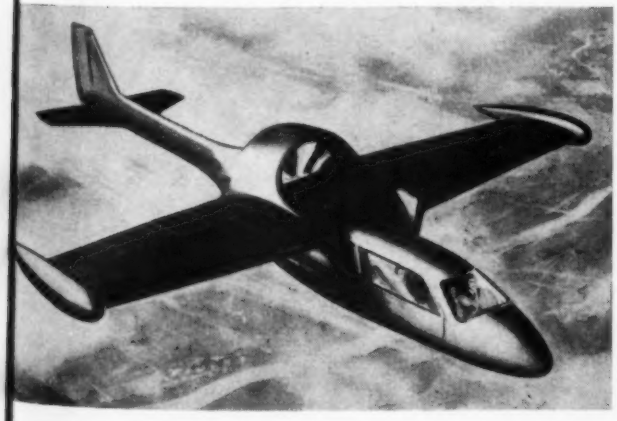
SCHEIBE-FLUGZEUGBAU GMBH, Dachau, near Munich

SF-23 Sperling A side-by-side two-seater, the Sperling is available in three versions: SF-23A1, with Continental C90 engine of 90 h.p.; SF23B, with Continental O-200A of 100 h.p.; SF 23C, with Lycoming O-235C1 of 115 h.p. For training and touring the

Scheibe SF-23 Sperling

Scheibe Motorspatz-1

Rhein RF1



ALEXANDER SCHLEICHER SEGELFLUGZEUGBAU, Poppenhausen an der Wasserkuppe

Schleicher Sailplanes The following types of sailplane are offered: *K8B* (single-seater for training and competition); *Ka6 Rhönsegler* (single-seat high-performance); *Rhönlerche II* (two-seat trainer); and *K7 Rhönadler* (two-seater for training and competition).

SIEBELWERKE-ATG GMBH, Donauwörth, Bavaria

Siebel SIAT 222 A four-seater powered with a Lycoming O-360 engine of 180 h.p., this aircraft is of all-metal construction. The canopy is jettisonable and there are front and rear baggage compartments.

Span, 30ft 7in; length, 25ft 4in; weight equipped, 1,300lb; gross weight, 2,315lb; cruising speed, 178 m.p.h.; range, 745 miles.

Siebel SIAT 223 Originated by the German Ministry of Economics, and specified by the German Aero Club, the SIAT 223 was recently chosen as the standard club and training aircraft. It is an all-metal two-seater with sliding canopy, interchangeable fin and tailplane sections, rectangular wing, tip-tanks, rubber-sprung undercarriage and powered alternatively by a 108 h.p. or 150 h.p. Lycoming engine.

Siebel SIAT 222

Siebel SIAT 223

THE GERMAN INDUSTRY . . .

It will meet CAR.3 in normal and utility category, is semi-aerobatic and can be used for glider towing. It is not known whether production is planned.

Span, 29ft 10in; length, 22ft 5in; weight empty, 935lb; gross weight, 1,650lb; cruising speed, 137 m.p.h.; landing speed, 53 m.p.h.; rate of climb, 1,760ft/min; service ceiling, 16,300ft; range, 650 miles.

WESER FLUGZEUGBAU GMBH, Werftstrasse 180, Bremen

C-160 The Weser concern is responsible for co-ordinating the design of the C-160 transport, developed by Arbeitsgemeinschaft Transall. The other participants are Hamburger, Nord (in France) and Blume. Having two Rolls-Royce Tyne R.20 turboprops of over 6,000 e.h.p. each as its primary engines, the C.160 can be equipped with an optional auxiliary installation of two RB 153 turbojets, each of some 4,000lb thrust. Military and civil applications are foreseen and in the former case the parachuting of heavy loads is possible.

Span, 131ft; length, 102ft; gross weight (normal), 92,600lb; gross weight (overload), 101,400lb; cruising speed (typical), 310 m.p.h.; take-off distance to 35ft, 1,970ft.

DFS 528 Designed by the Institute for Aeronautics, at Munich, this is a high-altitude powered glider intended for research and being built by Weser. It is intended to climb in power to some 60,000ft and to "loiter" for about 4hr. The engine is a Pratt & Whitney JT12A-6 turbojet of 3,000lb thrust. Span is 98ft and gross weight 9,300lb.

Weser Transall C-160

Engines

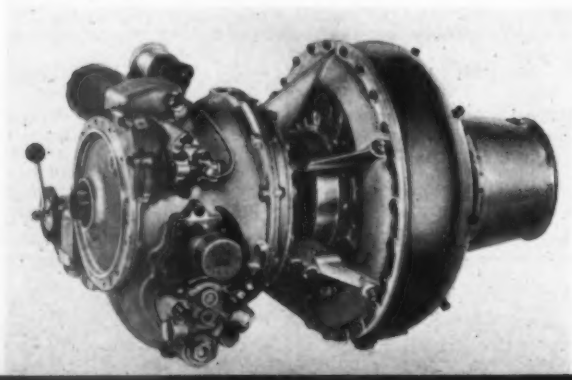
THE principal German engine constructor is **BMW Triebwerkbau GmbH** of Munich-Allach. Now established production under General Electric licence is the J-79-GE-11A turbojet for the Lockheed F-104G. Also participating in the J-79 programme are the Belgian FN and Italian Alfa Romeo concerns. Under Lycoming licence BMW are building the GO-480-B1A6 piston engine, besides servicing all types of Lycoming-manufactured engines.

BMW's own development programme includes, at present, the BMW 6012 gas turbine, with a rating of 90 h.p. and a weight of 99lb, and the BMW 8026, a small turbojet of some 110lb thrust and 84lb weight, intended primarily as an auxiliary unit for powered gliders.

Junkers Flugzeug- und Motorenwerke Aktiengesellschaft of Munich are reported to be developing aircraft gas turbines and *Klöckner-Humboldt-Deutz Aktiengesellschaft* of Cologne-Deutz are engaged in the Bristol Siddeley Orpheus programme for the Fiat G91.

For light-aircraft applications *Dr.-Ing. h.c. F. Porsche K-G*, of Stuttgart-Zuffenhausen, offer the following piston engines: Porsche 678/1 of 65 h.p.; Porsche 678/3 and 678/3A of 52 h.p.; and Porsche 678/4 of 75 h.p. Other piston engines, of about 45 h.p., and designated Stamo 1400A and 1400B, are made by Stark Flugzeugbau KG, of Minden/Westf.

BMW 6012 engine



Bölkow Cobra guided missile

Missiles

NOW in full production for the German Army and ordered for evaluation by several other countries, the Bölkow Apparatebau Cobra is an infantry anti-tank missile system. Each missile weighs 22lb, is made largely of plastics, has a range capability between 400m and 1,800m and carries a hollow charge capable of penetrating 24in of armour plate. Guidance is by single gyro and fluttering spoilers, controlled by wire from the ground. The missile carries a boost motor which lifts it off the ground without a launcher and can be turned up to 65° off its launch bearing. Batteries of eight missiles can be connected to one guidance position. The system includes field check-out box, battery charging adapter and a television simulator for guidance training. Multiple batteries for mounting on jeeps and other vehicles have been developed and the system has been evaluated by the US 7th Army and by the US Marines. Additional details are on page 617.

It is reported that a semi-automatic version of Cobra is being developed.

Sport and Business

UPPSALA UPS AND DOWNS

A British Parachuting Win

BY MIKE REILLY

British team members: with interpreter Ulla Britt Bergman are (l to r) Ron Griffiths, Norman Hoffman, Les Boddy and Robin Lett; (reclining) Pete Lang and Mike Reilly

ODD airfields around Europe have resounded for years past with the wistful phrase "Maybe next time?" From Bled, Pau, Tushino, Bratislava, Tivat and Leutkirch has echoed the fervent wish that one day, somewhere, a British team would at last mount the winners' rostrum in an international parachuting tournament. And now, at Sundbro airfield, near Uppsala in Sweden, the dream has become reality, for the British senior team took first place in the recent Swedish invitation contest. To add lustre to the occasion, the junior team finished second in their category, and September 1961 may well be recorded in future years as the month when British parachutists ceased to be merely polite also-rans.

The Swedish Aero Club is to be congratulated on organizing such a magnificent championship after only two years' experience of sporting parachuting. Governmental assistance, in the form of aeroplanes and military accommodation for the competitors, was available; but the necessary money was earned by public air displays at the start and finish of the contests. Parachute aircraft used included a D.H. Rapide (for the displays only), Cessnas, Austers and Piper Super-Cubs.

The international situation may have caused some cancellations, for the expected entries from Eastern Europe were not forthcoming, and there were last-minute withdrawals by the American and French teams. The final list of competitors included representatives from Austria, Italy, Germany, Belgium, Switzerland, Sweden and Great Britain.

In the senior class Britain was represented by Peter Lang (Wanderers Club), Norman Hoffman (Sky-Divers Club) and the writer (Ripcord Club). The juniors consisted of Les Boddy (South Down Sky-Divers) and Robin Letts and Ron Griffiths (Greenjackets Parachute Club). It is interesting to reflect that the Greenjackets are the first regiment of the British Army, other than units of Airborne Forces, to form their own free-fall parachute club. All members of the team paid their own expenses, but the trip was made possible by the kindness of the British Motor Corporation, who donated an Austin mini-bus. In this the party made an enjoyable journey from Ostend to Uppsala, and soon found on arrival that the bus was to be a great boon to all the teams.

Contrary to international custom, all jumps were to be recorded for the final result: there was no question of discounting one's worst attempt. However, all competitors had an opportunity of familiarizing themselves with local conditions during the introductory air display. The events were as follows:

(Juniors (parachutists with fewer than 50 jumps)

(*a*) Two jumps from 600m (2,000ft) with immediate opening of the parachute.

(*b*) Two jumps from 700m (2,300ft) with a maximum delay of 5sec.

(Seniors)

(*a*) Two jumps from 700m (2,300ft) with maximum delays of 5sec.

(*b*) Two jumps from 1,200m (4,000ft) with a delay of exactly 15sec. A maximum of 100 points would be scored for observing this time limit accurately, and penalties would be exacted at the rate of 20 points for every second less than 15, and 30 points for every second of free-fall in excess of 15.

No points were allotted for style, but in every jump the competitor was required to land on a target cross, seven metres in length and enclosed in a circle of 200m radius. Hitting the centre of the cross earned 200 points, and one point was lost for every metre away.

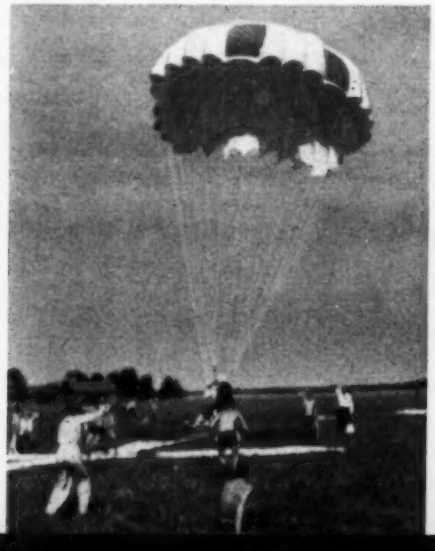
The display on the opening day provided great excitement for, in addition to a varied programme of aerobatics and military paratroop exercises, each competing team was asked to provide a display item. A gale-force wind made this a slightly forbidding prospect, but at the appointed time the British seniors leapt from 10,000ft for a "delay" of approximately 50sec. We were the only team to wear smoke-flares strapped to our ankles, and our trails, criss-crossing during the free-fall to 2,000ft, were apparently much appreciated.

For the first time in any tournament, we found that our parachutes were admired and coveted by other competitors, and there were numerous requests for information about modification equipment. It is, perhaps, a sad confession that none of us was using canopies of British design. Our equipment embodied American, Bulgarian and French ideas and rejoiced in such euphemistic names as "Conquistador," "Tiger-tooth TU" and "Bulgarian three-gore."

Most readers of *Flight* will by now be familiar with the principle of the blank-gore parachute, in which a segment of the canopy is removed in order to generate a "jet" of deflected air that propels one across the sky, and permits steering by pulling on one or other of two control lines. It suffices to say that our latest canopies have the equivalent of three segments (or gores) removed and provide a horizontal speed of up to 11 m.p.h.

The Austrians were using excellent Czechoslovakian parachutes, whilst many of the other nations preferred the American-designed TU. Smartest team on parade were the cheerful Italians (a highly subsidized party of mixed civilian and military jumpers), who used alternately the French EFA parachute and a new Italian assembly. Other teams used home-produced equipment which, if not impressive, was adequate.

[*Continued overleaf*



Left, German triangular canopy used by a Swedish competitor. Right, touchdown on the target by Helmuth Konig of Austria, individual winner in the senior class

SPORT AND BUSINESS...

Competition nerves blighted the first day of the championships. Usually staid performers persisted in believing that the strong winds of the previous day still prevailed, and there were many instances of undershooting the target on landing, due to selecting an exit point that was too far upwind. Les Boddy just missed the circle in this manner, but both Robin Letts and Ron Griffiths performed well, with landings of 13m and 8m respectively.

The seniors fared slightly better, with landings of 6m by Norman Hoffman, 7m by the writer, and 45m by Peter Lang. At the end of the first round both British teams were in the lead, and the succeeding days were to witness a similar position.

In the junior individual contest, Ron Griffiths fought for the lead each day with Richard Deutch (Austria) and Lino Trettel (Italy), whilst the senior lead alternated between Norman Hoffman and the writer, with Helmuth Konig of Austria striving to separate us.

Without exception, every competitor made at least one howling blunder which resulted in a poor jump, and there were many regrets expressed at the policy of no longer discounting the worst attempt. The wind was quite unpredictable, ranging in the space of thirty minutes from dead calm to the maximum permissible speed of 8m/sec.

It was left to Robin Letts to provide the most exciting spectacle of the contest. On his final jump he opened the parachute in a poor attitude, and several lines snaked over the top of the canopy, dividing it into several inefficient lobes. The fluttering bundle of washing spiralled earthwards at an alarming rate whilst spectators hoarsely entreated Robin to open his reserve (chest) parachute. He finally succeeded in inflating the second canopy, but then found that his damaged main parachute caused him to spiral across the field away from the target. With commendable presence of mind, he used the American patent quick-release shoulder buckles to jettison his main 'chute, and descended the rest of the way on his smaller (24ft) reserve canopy. On the way he caught up with his drifting deployment sleeve (which separates from the parachute on opening) and nonchalantly tucked it under his arm. Not satisfied with this demonstration, he contrived to land on his head, with feet quivering in the air, only 28m from the target centre! The Italian team had meanwhile gained a commanding lead in the junior section, so there was no sense in accepting Robin's gallant offer to jump again.

On the morning of the final day the senior team had a clear points-lead over their nearest rivals, the Austrians. Helmuth Konig had edged his way into second place in the individual rating, and British placings were now: Norman Hoffman first, the writer third and Peter Lang fourth. An average jump would confirm this position, and it was just conceivable that we might achieve 1st, 2nd and 3rd. But is there not a proverb about counting chickens?

Peter Lang jumped first, and scored full marks for length of delay. Unfortunately, he opened farther upwind than he had intended and had to blow-in all the way to achieve a landing of 21m. His previous jump had produced a touchdown of only 1.7m, so he was understandably disappointed.

I followed, taking off in a wind of 8kt for the climb to 4,000ft. At dropping height we turned into wind and with throttle almost closed puttered over the airfield. As I climbed out onto the Cessna's step, I noticed the parachute of Wielund Ruhmer (Germany) alight outside the circle, so I rapidly scrambled inside and bade the pilot make a second circuit. During this second run-in I asked myself why Ruhmer had missed the target. The wind might have dropped or changed direction; his aiming may have been poor, or he may have opened too low and left insufficient time to blow-in towards the cross. I scanned the ground beneath for signs of smoke, but the former obliging bonfires in neighbouring fields had all died. From this height it was impossible to judge the wind accurately by watching the small flags on the airfield, so I finally decided to gamble on the recent met. forecast being accurate: it had confidently predicted rising winds, and my previously estimated exit point of 350m upwind should permit me to tack accurately to the cross.

"Portrait of a disgusted Briton whose gamble failed" (Mike Reilly's own caption for this picture)

The target slid underneath for a second time, and 30sec later I stepped into space and started my stop-watch. Even as I adopted the familiar spread-eagled stable position and felt the comforting rush of upswept air, I found myself wondering whether Ruhmer could possibly have made a steering error. He was unknown to me before the contest, and it is misleading to judge an unknown jumper's capabilities.

Exactly at 15sec I pulled the ripcord, and, as the opening canopy slowed me to a near-halt, I found myself gazing down at a limp wind-sock—the breeze had died! Despite all my efforts I could only achieve a landing of 112m.

Norman Hoffman followed and made an identical error in selecting his exit point. He was further unfortunate in losing 30 penalty points for opening on the 16th second.

This unhappy last jump resulted in individual placings of Lang fourth, Reilly seventh and Hoffman ninth. The closeness of the scoring between first and ninth may be judged by the fact that we were still able to retain our lead in the team contest with a final score of 2,519.8 points, compared to the Austrians' total of 2,467.1.

The senior individual title went, deservedly, to Helmuth Konig of Austria, with Harald Zurcher (Switzerland) second and Pietro Gaffis (Italy) third.

Richard Deutch (Austria) captured the junior title, with Griffiths in second position, and Lino Trettel (Italy) third. Boddy and Letts finished eighth and ninth respectively.

The British success must be seen in perspective, for the results might have been different had the East Europeans and Americans competed. However, it was a well-deserved win in which all members played an equal part. There was never any doubt that our equipment was, at last, adequate for the task. Perhaps the nicest compliment was that fact that our parachuting technique was imitated by most other teams. Surely an encouraging omen for the future!

THE IRISH PARACHUTE CLUB'S annual rally, held traditionally on the Sunday following Battle of Britain Day, has become an eagerly anticipated annual event. Weston Farm is a combined farm and airfield only seven miles from the heart of Dublin, bounded on one side by a reservoir and on another by a golf course, and it may well be the only spot in the British Isles where one finds a cow and a Tiger Moth occupying adjacent stalls!

This year, in addition to the Irish competitors, there were four entrants from the American Forces in Europe (Golden Arrow Parachute Club, Germany), two from Scotland, and a dozen from England. The fair sex was charmingly represented by Maureen Brown (Scotland) and Detta Gormley and Mary Lawler of Ireland.

Competition is of secondary importance in this delightful event, and the main emphasis is on exchanging ideas and entertaining the large crowd which flocks from the city and neighbouring countryside. However, to add spice to the entertainment, an informal spot-landing contest is held during the afternoon, with the result determined by each competitor's best landing, irrespective of how many jumps he makes.

Competitors may jump from any height they wish, either singly, in pairs, or in sticks, and are encouraged to perform aerobatic manœuvres in free fall. Most jumpers used smoke-flares, and there were some easily discerned examples of good "tracking" (moving horizontally in a glide before opening the parachute) The Americans had brought their own Otter aircraft, and chose to jump from 10,000ft, whilst the remaining jumpers used Austers and Tiger Moths and had to be content with altitudes of up to 7,000ft.

Standards—both in free fall and precision landing—have improved since last year, and a closely fought contest ended with Norman Hoffman (Sky-Divers) winning for the second year running with a landing of 5m. P.F.C. Chace (US Army) was second with 7m, and Mike Reilly third with 7½m.

Irish hospitality was as excellent as ever, and the whole occasion will certainly be remembered with pleasure by all who attended.

M. B. R.

RESULTS of the Scottish Parachuting Championships held on September 22 and 23 were as follows:

Open Championship: 1, Mike Reilly (Ripcord Club); 2, Terry Jickells (22 SAS Regt); 3 Lt Col R. D. Wilson (22 SAS Regt).

Native Championship: 1, Jim McDiarmid; 2, Dr Charles Robertson; 3, Jim Currie.

The Right load in the Right place with the STOL Caribou

Supply dropping is a quick and easy undertaking for the STOL Caribou.

Air packs roll effortlessly out of the large rear door on roller conveyors—which also facilitate quick get-away when loading.

Four 1,500-lb. pallets can be dropped in rapid succession to land within a concentrated area.

Air drops of jeeps and 3,000-lb. pallets have been successfully demonstrated.

The Caribou's slow speed under full control, and straight-out rear exit, permit accurate delivery and close grouping of cargo.

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32 Duke Street, St. James's, London S.W.1

the **WESTLAND** range of turbine-powered helicopters includes machines to meet all forseeable requirements both Civil and Military...

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Old warriors, new mounts: Lightning F.1s of Treble-One Squadron, led by their CO, Sqn Ldr K. A. C. Wirdnam

SERVICE AVIATION

Air Force, Naval and Army Flying News

Visiting Skyshield

AT Colorado Springs last Saturday, in the headquarters of North American Air Defence Command, the AOC-in-C Bomber Command, Air Marshal Sir Kenneth Cross, was to watch progress of the joint air defence exercise, *Skyshield II*, from the combat operations centre. A force of Vulcans from his command, from 27 and 83 Sqns at Scampton, was taking part. Force commander was Gp Capt H. Burton, CO of the station.

Sir Kenneth had routine discussions during his visit to the US with the Commanders-in-Chief of Strategic Air Command and NORAD, respectively General Thomas S. Power and General Lawrence S. Kuter. Accompanied by the C-in-C Technical Training Command, Air Marshal Sir Wallace Kyle, he was also visiting SAC headquarters at Offutt, Nebraska, before returning home to the UK. The air marshals and their staff flew in a Britannia of Transport Command.

208 to Khormaksar

NOW that facilities are available at RAF Khormaksar, Aden, for operating two Hunter squadrons, 208 Sqn is moving there from Nairobi, Kenya, in December to join 8 Sqn. An Air Ministry announcement says that this move "will greatly improve the operational efficiency of the Air Forces Middle East since the two squadrons will be able to operate as one within the existing wing structure at RAF Khormaksar; while, from a maintenance point of view, the problem of having to provide spares for two Hunter squadrons stationed so far apart will be overcome."

Commanded by Sqn Ldr M. R. Goodfellow, 208 has been at Nairobi since early 1959 and while there has earned a considerable reputation as an aerobatic squadron. It is equipped with Hunter FGA.9s.

Farewell to Gee

DISBANDMENT this month of the last remaining Canberra squadron in Bomber Command—No 35, at Upwood—marks also the withdrawal from service of the medium-range radar bombing and navigation equipment known as Gee-H.

Introduced in 1943 and used initially by tactical aircraft, it was extensively employed after D-day when mobile ground stations were moved to the Continent. By October 1944 it was installed in many of the Lancasters of 3 Group, these aircraft being used for target-marking duties by night or as formation leaders in daylight attacks. In one daylight raid 120 aircraft, bombing through cloud, completely devastated an industrial area of Coblenz covering 250 acres. A developed version of Gee-H has been used in Canberras as a precision high-level bombing instrument.

Mr Ken Hayes, who recently travelled out to Singapore to present 60 Sqn with their original signed crest (this page, last week), pictured at Tengah. With him are, left, AVM Ramsay Rae, AOC 224 Group; and right, Air Marshal Sir Anthony Selway, C-in-C Far East Air Force

New Squadron Standards

FOUR more RAF squadrons with 25 or more years' service have been awarded standards. They are Nos 42, based at St Mawgan and equipped with Shackletons; 52 of the Far East Air Force, based at RAAF Butterworth, Malaya, and equipped with Valettas; 213, a Canberra squadron based at Bruggen in Germany; and 214, a Valiant squadron at Marham, Norfolk.

RAF in Aden

A RECENT report in *The Times*, after referring to the energetic Services' housing programme which is going on at Aden (see photograph below), describes current activities at RAF Khormaksar. "In the first four days of the recent crisis," the paper's special correspondent reports, "its transport wing lifted 4,300 men and 1,400,000lb of freight from Aden to Kuwait. More traffic passes through here than any other RAF base—3,500 aircraft and 6,000 passengers a month. No 8 (Hunter) Sqn [to which is being added 208 Sqn. See news-item in Col 1] and No 37 (Shackletons) defend Aden and the Protectorates from external attack and maintain law and order, the Hunters making almost daily sorties against troublesome tribes in the hill country. Sycamore helicopters carry out search and rescue work. Twin Pioneers, Valettas, and Beverleys of 78, 233 and 84 Squadrons maintain scheduled air services within the command from Bahrain to Eastleigh (Kenya) and supply ground forces in remote up-country bases. An extensive medical and casualty evacuation service is manned by the RAF and Army, whose 'flying doctors' can reach any point in the command."

Writing of the system of overall command of the three Services, the correspondent remarks: "Over 5,000 men of the Army, Navy and RAF are now jointly commanded by Air Marshal Sir Charles Elworthy, whose domain covers the Arabian peninsula, Kenya, Tanganyika, Uganda, and vast ocean areas. From the integrated headquarters in Aden are controlled British Army units of the colony garrison (at present the Queen's Own Surreys), the Aden Protectorate Levies, the RAF at Khormaksar, Steamer Point, and in East Africa, and HMS *Sheba*—the Naval establishment soon to become a pivotal point as headquarters of Flag Officer (Middle East). The joint command has achieved all-round economies, especially in manpower.

An ASR Sycamore from RAF Khormaksar seen over Maala Straight, the mile-long Aden thoroughfare flanked by blocks of flats housing British Servicemen and their families. These were built as part of the Protectorate's housing programme, the buildings on the right standing on reclaimed land. See "RAF in Aden," Col 3 above

SERVICE AVIATION...

RAAF Trainer Requirement

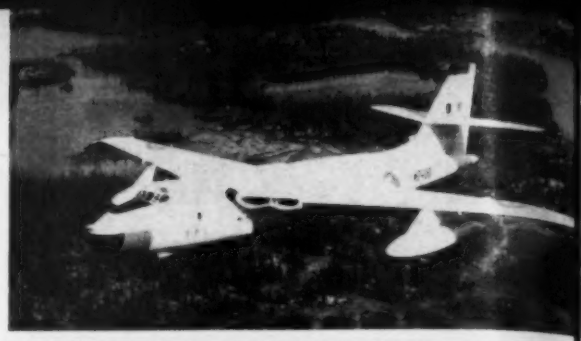
A STRONG effort is being made by Fuji Heavy Industries Ltd (writes Stanley Brogden from Australia) to sell the Fuji T-1A jet trainer to the RAAF. Their proposal is for Australian production of both the airframe and the Bristol Siddeley Orpheus engine. The Japanese really have very little chance, says our correspondent; for the RAAF would not countenance such a decision, and no politician dare face the consequences. Nevertheless, the Japanese argument that the Australian politicians must face such decisions to secure a more favourable trade balance with Japan (now some four to one in Australia's favour) cannot be disregarded entirely.

The RAAF at present operate Australian-built Vampire trainers, which follow on from the primary CAC Winjeel. They would like to have all-through jet training, with the introduction of the Mirage IIIC in 1963-64, but do not have the funds for this. They need a smaller trainer than the Fuji, as a primary jet trainer that could be used up to the stage at which pilots go on to a two-seat Avon-Sabre.

Most favoured types at the moment are the Hunting Jet Provost and Macchi MB326. A Jet Provost was loaned to the RAAF, operated for six months at Point Cook on evaluation, and is still in storage in Australia. The RAAF now feel that, as a decision would not be taken for two or three years, and deliveries would not begin for four/five years, a more modern-looking type would be preferable. This gives the Macchi an advantage. [The particular Jet Provost in Australia is an old model.—Ed.] Against the Macchi is its tandem seating, for the RAAF prefers side-by-side; but this is not considered a major factor. The Macchi's usefulness as a weapons and bombing trainer is impressive (the Cessna cannot be so used), and it would be useful in any local brush wars [as, no doubt, would an armed version of the Jet Provost —Ed].

Any order would be for 100 aircraft, and these would be made in Australia. De Havilland are favoured as they are not in production with any airframe at Bankstown or aero-engine at Lidcombe. The Viper, as installed in both the Jet Provost and Macchi, is well known to the RAF from the Jindivik.

The Canadair and Cessna trainers, like the Fuji, are considered too big, too costly and too sophisticated.



Visitors to RCAF Goose Bay, Labrador, from the Bomber Command Development Unit at RAF Finningley: a Valiant, seen over Canadian landscape...

... and (at right) the crew of a Vulcan with a member of the Royal Canadian Mounted Police. Crew members (left to right) are: Flt Lt J. H. Cox, Fg Off F. B. Martin, Sgt T. Robertson, Sqn Ldrs G. Curry and T. M. Fennel, and Flt Lts A. B. Frazer and R. B. Taylor

IN BRIEF

The Duchess of Gloucester visited RAF Lyneham, main Transport Command base in the United Kingdom, last Thursday. During her tour of the station the Duchess saw the operations room, servicing dock, a Britannia equipped for the triple role of passenger-carrying, freight-carrying and casualty evacuation, and the Route Hotel. At 216 Sqn headquarters, six WRAF airquartermasters were presented to her.

The Duke of Hamilton and Brandon, honorary air commodore of No 2 (City of Edinburgh) Maritime Headquarters Unit, RAuxAF, met members of the unit recently during their annual summer camp at Pitreavie.

Lt P. D. Deller and Able Seaman A. W. Baker of HMS *Osprey* (Portland) were recently commended by the Flag Officer Air (Home) in a special Order of the Day for their initiative, skill and courage. As pilot and aircrewman of a Whirlwind they recovered a body from the bottom of a cliff, following a request for assistance from the Dorset police, with an onshore gale blowing, low cloudbase and a rough sea.

At the height of the withdrawal of British forces from Kuwait over 500 aircraft, 4,332 men and 1,800,000lb of supplies passed through the RAF station at Bahrain. Cooks worked round the clock in kitchen temperatures of up to 160 deg, serving 37,000 extra meals.

The *Winter 1961/62* edition of the RAF Athletic and Games Handbook has been published. Copies are available from the RAF Sports Board, Air Ministry, London WC1 (Holborn 3434, ext 7537), price 4s.

Four crew members of a Whirlwind of 22 Sqn, operating from Manston, were rescued by Ramsgate lifeboat, with which they had been carrying out an exercise on Wednesday of last week, when their aircraft fell into the sea after rotor-blade failure.

The sixth RAF Anniversary Concert, held in London last April, resulted in £1,397 being raised for the RAF Benevolent Fund. The Fund has also received £1,000 as a result of an exhibition of Henry Moore sculptures at the Marlborough Gallery, Bond Street, London.

A detachment of 5131 (Bomb Disposal) Sqn are clearing 3,000 acres of moorland of unexploded missiles on the site of the new BMEW station at Fylingdales, near Pickering, Yorks. So far, some 187 missiles have been exploded. The work, which began in February, will take another nine or ten months to finish.

The annual reunion of 26 Sqn is being held in the Officers' Mess, RAF Biggin Hill, at 8 p.m. on Friday, November 10. Dress, lounge suits. Tickets (30s) can be obtained from Flt Lt N. Bacon, Officers' Mess, Central Flying School, Royal Air Force, Little Rissington, Glos.

Air Marshal Sir Denis Barnett, AOC-in-C Transport Command, shaking hands with Col G. A. Norris, Master of the Worshipful Company of Coachmakers and Coach Harness Makers, when members of the company recently flew to Lyneham as guests of 216 Sqn, which they adopted last June (this page, June 29)

Straight and Level

OVERHEARD at a recent aeronautical function:—

"My dear boy, if you want to get ahead in aviation today, never forget the lesson of the Wicked Fairy."

"The Wicked Fairy, sir? What lesson was that?"

"Simply this. It wasn't merely that the Wicked Fairy was Wicked. One could forgive her for that. But she failed to project a favourable public image of herself."

● FRUSTRATED Air Travellers who have failed to secure seats on LONDON - PARIS, LONDON - MANCHESTER or LONDON - GLASGOW routes this year are invited to contact advertiser (who is NOT in transport business but IS considering presentation of case to Air Transport Licensing Board).—Write Box U.1066, The Times, E.C.4.

Thus runs a recent advertisement in the personal columns of *The Times*. Following it up, I discovered that a small group of business men is behind it. One of them we know, and he is far from being what one might call a stunt man.

I am not sure that such a group can present its case to the Air Transport Licensing Board off its own bat, as it were; the batsman must be an applicant for the routes concerned, who would call on the group to give evidence of the need for the service.

Unfortunately, hearings of the British United application for London - Paris, and the Cunard Eagle application for London - Glasgow and London - Manchester, have already taken place. The decisions aren't yet out; but if the applications are granted, and *if* BEA appeals, this could be new evidence eligible to be submitted at the appeal.

It might be as well for the airlines concerned to see how the response goes to this advertisement. If it is good, British United and Cunard Eagle could call it as fresh evidence of the need for more seats; if it is poor, BEA will be wise to pounce upon it as evidence of the adequacy of their existing service.

Her name is Miss Missy Surface, and she's standing by a surface-to-air Bomarc missile—specially put in the picture so that aviation columnists could find an excuse for printing it

I say old chap, do watch your airspeed. And don't you think you're holding off just a bit too high? (Thinks: better not be too CFS-ish. This Masai warrior knows why the altimeter in a Beverley can read 5,400ft when the aircraft is on the ground—that's the height of Nairobi airport)

● QANTAS OPENS JET ERA 2 . . . NEW 707 V-JETS—*from a Qantas advertisement.*

Steady on, chaps—you're pinching American Airlines' gimmick. It was they who said they were introducing Jet Era 2 with their "Astrojets" some months ago. But, as I remember wondering at the time, wasn't it BOAC who introduced Jet Era 2 three years ago, with the Comet 4?

As for the names that the airlines' advertising boys dream up, steady, steady, *steady*. I still haven't heard from British United what an All Star Britannia is. At least "Astrojet" means something, in a meaningless sort of way. But I can't imagine what a 707 V-jet is. Surely the RAF doesn't need a fourth type of big bomber.

● "*The lack of sensitivity by those responsible in the Ministry of Aviation towards the buildings and the materials used within the buildings* [*at London Heathrow Central*] *illustrates in terms of aesthetics a moronic attitude of mind which overseas visitors are quick to notice.*" — Mr Leslie Julius, director of British Furniture Manufacturers' Exhibitions Ltd.

A spokesman for the Ministry of Aviation comments to *The Times*: "Certainly the Ministry would not claim that the present central terminal buildings are a show place for British furniture. Nor would any other group of public buildings that have six million people a year passing through them endure as a show place."

* * *

Perhaps the Ministry of Aviation spokesman should take a walk round the international arrivals building at New York, or round any of the individual airline terminals at that airport. For that matter he ought to have a look at the terminal buildings at Copenhagen, Paris Orly, Kano and Nairobi—and at a dozen other new airports around the world. They all make the interiors of London Central and London Gatwick look the epitome of frumpishness.

Let's hope that the new long-haul terminal at London Heathrow will show that British interior airport design can match the world's best.

● Have you heard the one about the learned advocate who was arguing his case before an appeals commissioner on a decision of the Air Services Licensing Council?

"The essence of Plummet's case" he said, "is that they have ordered an additional 45 Speedliner jets on the assumption that they will carry the entire British share of traffic on the London - Potters Bar route until 1975. Without wishing to lay myself open to the charge of being a 'gramophone record,' I say without hesitation that if Mammoth is allowed, as a second British carrier, to operate three DC-4s over this important route, on which there are already no fewer than 26 other carriers, it will result in material diversion, material diversion, material diversion, material diversion, material diversion . . ."

ROGER BACON

A 32-year-old Lockheed Vega being used by General Electric for radar tests. Metal parts have where possible been replaced by wood and plastics to reduce reflectivity. The propeller is of laminated wood. The aircraft can still reach 20,000ft and 180 m.p.h. and is one of four remaining out of the 130 built

FLIGHT SYSTEM SURVEY

Slowed-down Video

DEMONSTRATED for the first time in Toronto earlier this month was a land-line transmission system for radar pictures, developed by Raytheon Canada Ltd. By this method the bandwidth occupied by a video picture can be compressed to 3kc/s, the image first being fed into a scan converter and up-dated every ten seconds. The information sent over the telephone line is up-dated once every 40sec, but no loss in data rate would result with slightly better lines.

The main advantage of the new system, called slowed-down video, is that radar pictures can now be transmitted over land-lines at much lower cost than for existing micro-wave links. Alternatively, micro-wave links could be used to transmit hundreds of radar pictures over the bandwidth now used for single transmissions. Reduced cost and greater simplicity makes it possible to apply multiple remote transmission to single centres, or the transmission of video from one radar to many sites. All types of radar presentation can be handled.

Raytheon Canada claim that Department of Transport air traffic controllers will now be able to hand-over aircraft traces visually from one centre to another. Additional uses include surveillance of all ship traffic on the St Lawrence Seaway, using many radars but a single control centre; and for linking branch offices of a bank with headquarters for verification of bank signatures.

One Every Three Working Days

SINCE Midsummer's day Elliott Automation have sold 22 computers in 63 working days—one every three working days. The sales include 18 National-Elliott 803s, three NCR 315s and a National-Elliott 405. Excluding the NCR 315s, a total of 126 National-Elliott computers have been ordered and 90 delivered, one-third of them for export. Customers include several government aviation establishments and aircraft manufacturers; and the MoA has a 502 on order for system simulation study and another for the experimental air traffic control system. A number of special-purpose digital computers, not included in the total above, have been made by Elliott for defence purposes.

Now, Elliott have formed the Special Computer Division within their group of data processing divisions to study problems associated with the on-line application of digital computers to continuous operations. An example is the co-ordination of a wide variety of inputs into a computer which is at the same time providing an equally wide variety of outputs. The division is at present studying an experimental air traffic control system.

UHF for the Super Starfighter

THE first of 250 UHF emergency transceivers for the CF-104 was delivered by Collins Radio Co of Canada eleven days early. The unit weighs 9.4lb and provides five-watt transmitter power for communication on two channels in case of failure of the main power supply or primary radio. The latter is the ARC-552A, made by Collins in 1,750 and 3,500-channel versions and standardized for all F-104Gs, CF-104s and F-104Js.

More Doppler for the Wessex

A FURTHER order has been placed with Ryan Electronics for APN-97A Dopplers for Westland Wessex anti-submarine helicopters. This time the order was placed by Westland themselves and not by the Royal Navy. The APN-97A is designed primarily as a ground velocity indicator for helicopters and provides outputs for instruments or autopilot which will allow the pilot to keep the machine stationary over a given point. Parameters sensed are heading speed, drift speed and vertical speed and the outputs may also be used for position or course and distance computers. The control and attack system of the Wessex is produced under Lear licence by Louis Newmark in Britain; and the Texas Instruments dipping Sonar is made by R. B. Pullin.

Ryan has also signed an agreement with the Compagnie Française Thomson-Houston covering repair, overhaul and maintenance of Ryan Dopplers in Europe. At a later stage, CFTH might manufacture such equipment under licence.

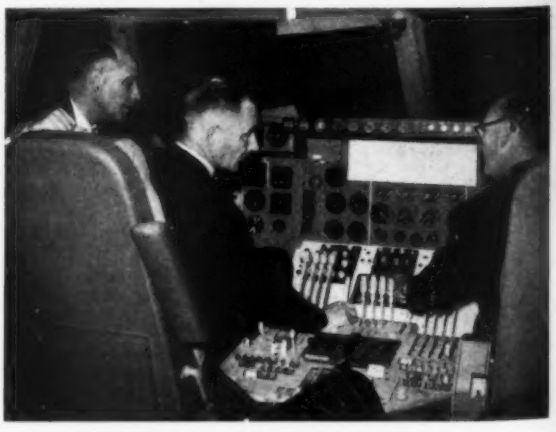
Racal in Australia

RECENTLY formed for the purpose of marketing Racal and other products in Australia and mandated territories is Racal (Australia) Pty Ltd. The company will work closely with Commonwealth Electronics Pty at Sydney; and Racal Electronics, the parent company at Bracknell, will market their products in Britain. The managing director of both Commonwealth Electronics and Racal (Australia) is Mr R. S. Hope, who spent many years with Standard Telephones & Cables.

Another ILS and Mercury

THE Centre d'Essais en Vol at Brétigny, near Paris, is to be equipped with a Pye ILS system incorporating the directional localizer. The total number of Pye ILS systems in service now exceeds 35.

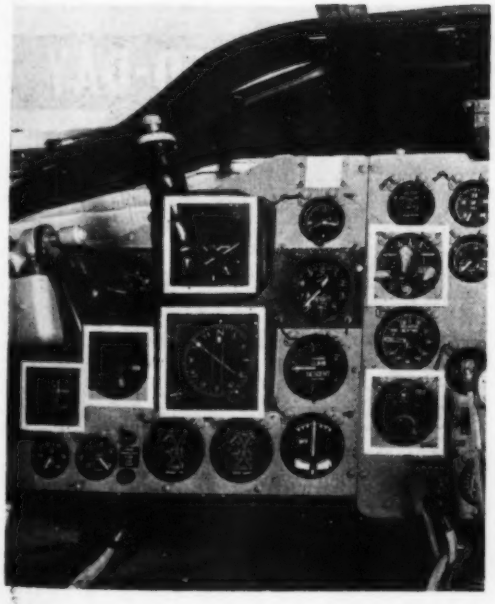
Recently announced by Pye Telecommunications is the Mercury Type PTC 986 HF radiotelephone intended for use overseas where power supplies are limited. The modulator and power supply of the transmitter and the whole receiver are transistorized; and the set is sufficiently robust for mounting in a vehicle. Eight transmitter channels can be preset, four in the 1.6 to 3.8Mc/s band and four in the 3.8 to 10Mc/s band. The built-in speaker or headphones may be used and the receiver is continuously tunable over the broadcast, medium short-wave or short-wave bands. Printed circuits are incorporated and the two units can be individually removed from the combined chassis. The transmitter has an RF output of 20W minimum and either 12V or 24V power supplies are available.



A recent view of the Short Belfast cockpit mock-up being inspected by Air Ministry and MoA officials. Note the radio control panels on the sloping console and the Smiths triplex autopilot panel aft of the throttle levers. Control position indicators are on the glare shield

SPERRY answers the Operator's need

"During the four world demonstration tours undertaken by the Dart Herald, the Sperry equipment proved to be outstandingly efficient and reliable. The AL.30 light-weight Gyropilot does 95% of the job of a fully sophisticated system at a fraction of the cost, and it is extremely simple to use. I have yet to find a pilot anywhere who cannot fly on the Zero Reader flight director".
Sqn. Ldr. Hazelden, Chief Test Pilot, Handley Page Ltd.



By coupling the well-proved AL.30 light-weight Gyropilot to the ZL.1 Zero Reader flight director, Sperry engineers have brought main-line standards of instrumentation and flight control to the Handley Page Dart Heralds entering service with the Jersey Air Lines and British European Airways.

The performance and reliability associated with each instrument are now integrated without complexity or significant weight increase, offering automatic ILS approach capability at an economical cost. Other British Sperry equipment includes the Gyrosyn Compass and Horizon Gyro Unit (Type B).

New branch and feeder liner projects form one of many important aspects of Sperry's aeronautical work. The Company is currently engaged on navigation, guidance and control problems for VTOL and helicopters, as well as fixed-wing aircraft; these offer long-term interest to electronic and electro-mechanical engineers and designers, on stable platforms, auto-stabilizers, auto-pilots and instrumentation. If you would like to play a part in

solving tomorrow's problems today | SPERRY

. . . we invite you to discuss your place in projects of this nature with KEITH STONEMAN. Tel: BRACKNELL 1301

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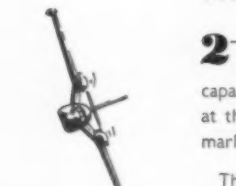
PIAGGIO

Seven Quotes on the Piaggio P.166

2—"As a readily available luxury executive aircraft with a performance and capacity well ahead of many other aircraft at the same price, it should command a ready market.

The layout of the P.166, with its high wing and rearward facing engines, is particularly suitable for both pilot and passengers. The whole cabin is forward of the wing and the engines are sufficiently far aft to keep the interior extraordinarily quiet. In the six-seat layout which was shown, there was plenty of room between the seats and a large aisle made movement easy."

The Royal Aero Club Gazette
July 1959



PIAGGIO of Genoa

YESTERDAY, TO-DAY

AND TO-MORROW

GENUINE Jubilee REGD. TRADE MARK

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Jubilee CLIP DRIVER

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TEL: GILLINGHAM 51182/3

HAWKER HISTORY, newly recorded in Mr Francis K. Mason's book "Hawker Aircraft Since 1920," published by Putnam, is epitomized in this fine study of the surviving Hart, flown by Duncan Simpson. Formerly Hawker's demonstration and development Hart registered G-ABMR, it now bears the Service number J9933, which actually belonged to the first production Hart bomber for the RAF. In point of fact the former "MR" differs considerably from RAF Harts, notably in having a supercharged, instead of a normally aspirated, Rolls-Royce Kestrel engine

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Reheat in Turns

DURING the SBAC Display, which I attended on September 5, a Lightning performed several very tight turns. The commentator particularly called attention to the fact that the aircraft could be "kicked" (his word) into a tighter turn by the use of reheat, i.e., increased thrust. This was demonstrated and indeed the increase in the rate of turn on applying reheat was clear.

The point of this letter is to ask for an explanation of this effect. I may say that I have been led into much argument about this and would value some assistance.

Since the Lightning has two engines mounted one above the other, the increased rate of turn could presumably be achieved by "lighting" the lower engine only to reheat; but I gained the impression that both engines were on reheat.

Perhaps someone could settle a subsidiary argument on this subject. Does the centre of thrust along the axis of the aircraft alter on application of reheat? This may be completely unconnected with the first question, but I would appreciate an answer.

West Byfleet, Surrey C. S. MAPLE, Maj

[Wg Cdr R. P. Beamont, manager flight operations, English Electric Aviation, has made the following comments: "I am glad that demonstration of the use of reheat coincident with increase in incidence did in fact have the effect of drawing the onlookers' attention, as this was precisely the intention.

"The position of the engines mounted one above the other has no noticeable effect on trim, and so does not alter the thrust line significantly with the use of both or single reheat; neither does use of reheat 'kick' the aircraft into increased rate of turn. This was an intentional illusion.

"What the onlooker was seeing was the aircraft initially balanced at a combination of maximum cold thrust and a g value at which the total drag value (mostly induced) exactly balanced out at a stabilized speed. From here g could not be increased without rapid loss of speed unless more power was used, so at this point maximum reheat was engaged and incidence further increased to reduce the radius of turn down to the point where this further increase in induced drag exactly balanced maximum reheat thrust at stabilized speed.

"The trick was to bring off these various points of balance at the appropriate places relative to the spectators, but there was no question of the reheat itself kicking the aircraft into an increased rate of turn."—Ed.]

Skybolts over Cheshire

WOULD the following information be of interest to your readers, or has it already been noticed? At 4.45 p.m. today (October 4) a Vulcan B.2 flew over this area, probably to land at nearby Woodford. The interesting feature was that it carried two GAM-87 Skybolt missiles, which could be clearly seen hung on pylons just outboard of the engine nacelles. The missiles appeared to have a smaller number of more-squared fins than the ones in your photograph in *Flight* for June 15. There were no markings under the wings of the Vulcan.

I would like to take this opportunity of saying how much I look forward to my weekly *Flight*, which I have been taking now for two years.

Cheadle Hulme, Cheshire. STEPHEN DULSON (aged 12)

Persian Gulf Pioneering

THE interesting article by Gp Capt John A. McDonald in your issue of October 5, *Early Flying in the Persian Gulf*, unfortunately does not give credit where credit is due. It was No 203 Sqn, and not No 205 Sqn, that was based on Basra and that opened up the Persian Gulf for landplanes.

I was in No 203 Sqn from 1930 to 1932 and took part in the Masira Island and Merbat flights. Two Supermarine Southamptons made the first flight to Masira to survey and mark out the landing-ground. We were the first foreigners to land for some 50 years. In this operation we were supported by HMS *Penzance*. The Merbat operation took place about a year later with two Short Rangoons.

St Helens, IoW F. R. DREW (Gp Capt, Ret)

Wanted: Me262 Information

I WISH to appeal for reminiscences and general information concerning the world's first operational jet fighter—the Messerschmitt Me262—on which I am preparing a book.

This Luftwaffe fighter saw limited service in the Low Countries and more extensive use over the German homeland from July 1944 until the cessation of hostilities in May 1945. Very little has ever been published on this last phase of the air war, and although

Me262, subject of the letter from Mr Richard P. Bateson

CORRESPONDENCE...

I have recently received help from the German authorities (notably by being allowed to do research in the archives of the Luftwaffe-Studiengruppe at Hamburg/Blankenese), due to the majority of the contemporary records having been destroyed or otherwise lost to public view the only satisfactory way of tracing the combat history of the Me262 is by enlisting the aid of those who were actually involved with, or affected by, the introduction into service of this revolutionary aeroplane.

I am most anxious to contact any ex-RAF personnel (or other Allied aircrew for that matter) who met this machine during the course of their wartime flying duties, and can provide details of actions involving Me262s from logbooks, diaries or other documents of the period.

It would also be most interesting to hear from ground personnel who were stationed on the Continent during the advance into Germany who may have experienced bombing attacks by these aircraft; others holding photographs of captured specimens taken at overrun airfields; and technicians and pilots who were intimately associated with the type during trials held at Farnborough and elsewhere after the war.

All possible care will, of course, be taken with any photographs or documentary material loaned by correspondents.

16 St Mary's Grove, London W4 RICHARD P. BATESON

FORTHCOMING EVENTS

Oct	19	RAeS: Fifth Lanchester Memorial Lecture, "From Ship-accompanying Waves to Shock Waves of Supersonic Aeroplanes," by R. Legendre.
Oct	23-24	International Airline Navigators Council: European Regional Meeting, Paris.
Oct	25	Kronfeld Club: Annual General Meeting.
Oct	25	Society of Environmental Engineers: "Structures and Components at Elevated Temperatures," by A. M. P. Brookes.
Oct	26	Institute of Transport (London): "Development of New Aircraft and their Testing," by Sqn Ldr H. G. Hazelden.
Oct	30	RAeS Historical Group: Lecture by Sir Frederick Handley Page.
Nov	1	Royal United Service Institution: "Thoughts on the Nuclear Deterrent," by Marshal of the Royal Air Force Sir Dermot Boyle.
Nov	3	RAeS Rotorcraft Section: "Electronic Flight Information Displays for the Rotary-wing Aircraft," by Wg Cdr J. C. G. Bell.

RAeS Branch Fixtures (to Oct 26): Oct 24, Glasgow (Graduates' and Students' Section), Lecture by Peter Gibbs. Oct 25, *Weybridge*, "The Supersonic Transport," by Dr A. E. Russell.

Cody's Family Tree

ROGER BACON'S colleague who eats our salt and wheedles our secrets should not allow my assistant's charms and vital statistics to blind him to even more vital statistics.

Gillian Cody *is* 18 *but* she is a great grand-daughter, not a grand-daughter. It rather stands to reason, when you come to think of it.

London W1 F. H. SMITH

[Roger Bacon's colleague writes: "I apologize for the error in transcribing the results of my historical research. I would be the first to agree with Mr Smith that Miss Cody is great."—Ed.]

CORRESPONDENCE IN BRIEF

The Keeper of Exhibits at the Imperial War Museum, Lambeth Road, London SE1, writes to say that, notwithstanding the implication of the wording on the notice-board displayed with the Sea Gladiator *Faith* (photograph, page 513, September 28), no parts of that aircraft are in the keeping of the museum, nor have they been at any time.

THE INDUSTRY

Shoeing the Shackleton

ILLUSTRATED below is an aircraft tyre of one of the largest sizes made in this country. Originally designed for the Lancaster, Lincoln and Halifax, and still in service on the Shackletons of Coastal Command, it is a 64 × 22.50-26, and is now being made by the Firestone Tyre and Rubber Co Ltd in a new version having a high-tensile nylon (instead of rayon) carcase which effects considerable weight saving. The carcase is of 18-ply rating and has a high-speed tread.

Standing 5ft 6in high and of 2ft cross-section, the tyre operates at an inflation pressure of 70lb/sq in, will carry a static load of 17 tons and is capable of taking an impact load of 50 tons.

An MoA order, state the company, has been received "for a large quantity of these tyres to a completely new and advanced Firestone specification and tread design." They add: "The first tyre left the cure just under six months from the time pencil first touched paper in designing it, and for a tyre of such size and complexity this must be considered quite an achievement."

A Firestone inspector with the Shackleton tyre described in the news-item above

(Left) Mr Alex Laurence, formerly secretary of Hawker Aircraft (Blackpool) Ltd, is now secretary of Hawker Siddeley Aviation

(Right) Rear Admiral G. C. Ross, who, as announced last week, is Blackburn's new Service liaison officer

EE Subsidiaries Board Changes

CHANGES in membership of the boards of its subsidiary companies have recently been announced by the English Electric Co Ltd, as follows:—

Marconi's Wireless Telegraph Co Ltd: The Hon George Nelson has been appointed chairman, succeeding Lord Nelson of Stafford, who remains a director of the company. Sir Gordon Radley has been appointed deputy chairman.

Marconi Instruments Ltd: Sir Gordon Radley has been appointed chairman, succeeding Lord Nelson of Stafford. Mr F. N. Sutherland becomes deputy chairman. Lord Nelson, the Hon George Nelson and Mr P. Horsfall retire from the board. Dr E. Eastwood has been elected a director.

English Electric Valve Co Ltd: Sir Gordon Radley has been appointed chairman, succeeding Lord Nelson. Mr P. L. de Laszlo becomes deputy chairman. Lord Nelson, the Hon George Nelson and Mr P. Horsfall retire from the board.

The announcement also gives details of changes in the board of Marconi International Marine Communications Ltd, of which Sir Gordon Radley is appointed chairman.

IN BRIEF

Ampex Great Britain Ltd are now located in new premises, at 72 Berkeley Avenue, Reading (tel Reading 55341, Telex 84146).

Mr William H. Rigg, BSC, has been appointed managing director of Firth Cleveland Tools Ltd, a member of the Firth Cleveland Group. For the past three years he has held a similar position with Revo Electric Co Ltd.

Two addresses given in the list of manufacturers of electronic equipment in our October 5 issue call for amendment. Vactric Control Equipment Ltd now have their offices at 30 Bouverie Street, London EC4 (telephone Ludgate Circus 7061), and also have acquired a site for new premises at Garth Road, Morden, Surrey; and Davis & Timmins (Aircraft) Ltd, are at Billet Road, London E17 (Larkswood 2313).

A passenger embarks on the 10.20 flight from the Wall Street heliport at Manhattan bound for Idlewild via La Guardia. As a note below describes, public helicopter transport in America now seems as routine as any other form of public transport

"Flight" photograph

AIR COMMERCE

A Ride with New York Airways

WHILE some things American are inclined to be flashy and over-emphasized, one aspect of American life is as matter-of-fact as it could be—air transport. This is a business in which the Americans excel, and in which they know they excel. They have the market, and it is half the air transport market of the world. One has only to see Eastern's airbus operation—no reservations, seats guaranteed, departures on the hour every hour—to appreciate how far behind are other countries in the operation of matter-of-fact air transport.

Even helicopter operations are now just about as routine as they could be. A member of *Flight*'s staff, recently in New York, decided to sample the New York Airways helicopter service as an ordinary fare-paying passenger. We rang the airline's office at 9 a.m. to book a seat to be told: "Sorry the 9.50 flight is wait-listed. Would a seat on the 10.20 flight for Idlewild be acceptable?" It was, and we checked in at the Wall Street heliport on the East River at ten o'clock.

A clerk issued a ticket, costing some $7, within five minutes, and we strolled out on to the landing pad jutting out into the East River to watch the arrival of the Vertol 44B. As it came into sight a brief exchange between the pilot and the ticketing clerk (who was now acting as flight despatcher), was heard over the loudspeaker in the small terminal building. "What are all those fire boats doing?" asked the pilot. "Couldn't say," replied the flight despatcher, adding: "The wind's coming from the east now, Howard."

Howard landed, the door of the Vertol opened, and above the noise of the single Wright Cyclone and the twin rotors the despatcher called out to us: "You get off at the second stop"—as if we didn't know we were going to Idlewild via La Guardia, and almost as if we didn't know it was a helicopter and not a Green Line bus.

There were about half a dozen people occupying the 15 seats inside. Evidently they were everyday users of the service, because they didn't seem to be as filled with wonder as we were at the sight to be seen out of the windows—Manhattan island, downtown New York, the United Nations building, the busy bridges flung across the East River, and—dominating the towering skyscraper-scape—the Empire State Building. A ride in a New York Airways helicopter offers, in addition to "transportation," one of the most wonderful sights in the world.

"This is La Guardia," one of the two pilots was saying over the public address system. (The door into the cockpit was open, and both drivers could be watched at work.) We landed by the American Airlines base. A few people got off and a few more got on.

The take-off appeared to involve quite a long forward run. There before us, out of the window, and receding quite fast, were the runways of La Guardia. As we watched, one Electra landed on Runway 31, a National DC-7C and an executive Gulfstream took off, an Aero Commander and two Electras were waiting their turn at the run-up point. We did not see any jets, La Guardia's runways being too short for these aircraft.

A few minutes later we were at Idlewild, alighting near the American Airlines terminal. A New York Airways bus—white and blue—was awaiting us, and drove off to make a call at each of the individual airline terminals at New York International. We jumped off at the Eastern Air Lines terminal with lots of time in hand for the 11.30 DC-8 jet flight to Miami, our baggage magically appearing at our side.

The whole trip took 23min, about one-third of the time that would have been taken by a taxi. No doubt our $7 ticket covered only a third of the real cost of the flight, the rest being made up by FAA and Post Office subsidy. But with helicopters you have to get to the matter-of-fact stage operationally before you can, with the right helicopter, make money unaided. Perhaps New York Airways, who are soon to introduce Vertol 107s, will reach this stage in two or three years' time.

THE ATAC's LAST REPORT

THE final report of the Air Transport Advisory Council for the year ended March 31, 1961,* reveals that the ATAC had a very busy final year, not only dealing with existing applications but preparing the way for the Air Transport Licensing Board. The latter began accepting applications last December, and the ATAC ceased to accept new applications after November 30, 1960.

No less than 1,438 were considered during the 111 meetings held by the Council during the year; some were later withdrawn and some lapsed, but recommendations were made to the Minister on 1,317 applications, and in no case did the Minister find himself unable to accept the Council's recommendations. A good deal of this work involved transitional licensing for services to be operated between March 31 and October 31, 1961, in particular group charters.

The report points out that although between 1953-54 and 1960-61 the annual traffic in load ton-miles of the independents increased about six and a half times and that of the corporations about two and a half times, the independents' share of UK traffic had increased from 4 per cent to only 10 per cent. Twelve companies submitted applications for the first time during the year in question and one—Scottish Airlines (Prestwick) Ltd—ceased scheduled operations with the transfer of their Prestwick - Isle of Man service to Dan-Air.

A rather higher proportion than usual of normal scheduled service applications was rejected, in several cases (i.e., Genoa, Faro and Madeira) because the necessary aerodrome facilities were not yet available. The only Colonial Coach application was from Starways for a service to Bechuanaland, which was rejected as it did not seem likely to generate a new class of passenger traffic. With the Council's approval, BEA and BKS exchanged certain Biarritz and Oporto services, and operators using Eastleigh were allowed to transfer their services to Hurn when the former was closed. At the beginning of its last year, the ATAC had outstanding nine applications for helicopter services, which had been advertised and one of which was later withdrawn, and 21 more which had not been advertised pending inquiries into the applicant's operational standing and terms and conditions of employment. Following the authority given to the Council by the Minister to decline to consider any application if it was in the Council's opinion no longer appropriate for it to do so, the Council reached the conclusion that, "as the applications were premature and as the future pattern of helicopter operations raised such wide issues, it was preferable that the applicants should apply at a later date to the Air Transport Licensing Board." The Council therefore declined to consider any helicopter service applications.

In reviewing its history, the Council makes the point that the public hardly made any use of it at all as a channel for complaints—although they have always been entitled to. Only 59 such complaints have been received in the 13½ years of the ATAC's existence, and in its earliest reports, the Council repeatedly drew attention to this failure to make use of its facilities and "suggested that complaints might more appropriately be made to it than in articles and letters in the Press and questions in Parliament." It is interesting to speculate on what might have been the result of the Very Low Fare applications had the ATAC's other function as a channel for complaint against such things as overcharging been more widely appreciated. Curiously enough, the report makes no mention of VLF nor of Skycoach, in spite of the influence these had on British air transport during the year under review.

* *H.M. Stationery Office, price 6s 6d net.*

As recorded last week, the American firm Turboflight has placed what is described by Potez as "a firm order" for 120 Potez 840s to be delivered starting in 1963 and for five years thereafter. The Potez factories at Argenteuil and Toulouse are planning to produce the aircraft at the rate of 48 per year. The second 840 is due to fly before the end of this year

AIR COMMERCE...

£10m LOSS FOR BOAC?

BOAC may record its heaviest deficit for 11 years when the financial results for 1961-62 are published. The loss, anticipated as likely to be "very heavy indeed" in *Flight* for August 3, may be as high as £10m.

The main cause of BOAC's financial plight is that the expected increases in traffic have not materialized at a time when the corporation has increased capacity. In fact, up to June 1961, BOAC's traffic to the US east coast decreased by 4.8 per cent compared with the previous year, whilst traffic between the UK and USA up to September 1961 increased by only 2.8 per cent. According to Sir Basil Smallpeice, BOAC's managing director, at the recent appeal, the corporation has recorded a loss of £650,000 during the first 16 weeks of 1961-62 on the UK-US east coast route alone, compared with a profit of £300,000 during the same period in 1960.

Contributory causes are the effect of the strikes and stoppages in June and July, which are estimated to have cost the corporation £2½m (£1½m in passenger fares) and the financial results of BOAC Associated Companies Ltd, which accounted for £2m of £2.5m loss recorded by the corporation in 1960-61. As briefly recorded last week, BOAC and the Trinidad Government have agreed on terms for the transfer of BWIA from BOAC Associated Companies to the Trinidad Government. The agreed price is about £520,000 for a 90 per cent Trinidad Government share, BOAC retaining a 10 per cent share. This price is understood to exclude four Viscounts which belong to BOAC and are chartered to BWIA.

It is apparent that BOAC has, in effect, made a present of BWIA to the Trinidad Government. A price of £½m is considerably less than the valuation of the airline originally made by BOAC of some £5½m (see *Flight*, October 5, 1961, page 563). That price included the Viscounts at a book value of just over £1m, and it included also BWIA's accumulated losses of £3.21m—losses which, a year later, stood at £3½m. Thus it appears that BOAC is standing a loss of between £3m and £4m on this transaction, most of this being made up of BWIA's accumulated deficit. The deal is an extremely generous one, although it is unlikely that BOAC has many bargaining counters now that Jamaica, having decided not to join the West Indies Federation, is unlikely to participate in the new West Indian airline.

Although BOAC has clearly lost heavily in relieving itself of BWIA, it has not lost nearly so much as it has done in dissociating itself from MEA. No figures for the amounts written off by BOAC in that transaction are available; whilst the sum owed by MEA to BOAC was said to be £1½m, the actual sums loaned over the past few years to MEA by BOAC are more than £5m and probably as much as £9m. At a conservative guess, therefore, BOAC has written off at least £8m in relieving itself of BWIA and MEA—figures which, when taken into account with the calamitous shortfall in traffic during the current year, are likely to give BOAC its heaviest financial millstone for 11 years.

BOAC has now concluded an agreement with Air Ceylon, effective November 1, whereby the corporation will operate on behalf of and in pool with the Ceylonese airline (*Flight*, October 12, page 595). The corporation has agreed to bear losses incurred during the first year of operation, so that another red ink entry is likely to appear in the corporation's accounts for 1961-62.

AIRPORT ECONOMICS DISCUSSED

SOME interesting comments in a paper read before the Aerodrome Owners' Association (briefly reported on page 599 of last week's issue) were made by Mr R. S. F. Edwards, general manager, London Airports. Pointing out that UK landing fees amounted to some 5 or 6 per cent of the operator's average stage revenue, rising to about 10 per cent on domestic services, Mr Edwards thought it likely that one would have to make very drastic cuts in landing fees to encourage airlines to operate their aircraft during unpopular or uncommercial periods. For Heathrow, interest on capital accounted for 21 per cent of expenditure over the past three years and depreciation 15 per cent. Pointing out that many airports did not include interest charges or depreciation in their accounts, Mr Edwards said: "If we at Heathrow did not include interest on capital and depreciation we could show a profit of nearly £2m. At Gatwick these items account for more than half the deficiency."

Car parking, said Mr Edwards, has been held to be a money-spinner just because of the large number of cars wishing to park. But the thing the critics never mention is that land in the centre of London Airport is almost as valuable as land in the centre of London and no one in their senses would consider it a business proposition to rent land in Piccadilly for a car park. Unless such parks are filled every day of the year they cannot hope to pay off the amortization of capital, much less the ground rent.

One of the aerodrome operator's main difficulties, he said, was the lack of any nationally or internationally accepted basis for the rendering of aerodrome accounts, and this invalidates any deductions about relative efficiencies based purely on the total costs. Mr Edwards pointed out that the services provided under the heading of "landing fees" are far more embracing in this country than in other countries which raise individual charges in addition to the landing fees for a number of ancillary services.

HELIPORT SITES VETOED

ALL three heliport sites recommended as the most suitable in the report of the Committee on the Planning of Helicopter Stations in the London Area (*Flight*, August 3) are being opposed by local authorities. As reported in *Flight* last week, the Court of Common Council of the City of London has been recommended to oppose the Ministry's plan to use the roof of Cannon Street station, and this recommendation has now been accepted. Battersea Borough Council Highways Committee on October 9 considered the Nine Elms site and decided to recommend to the Council to object to a permanent heliport there. This leaves the third site, St Katharine Docks.

Stepney Borough Council, it is reported, will be recommended to oppose this third site on the grounds of noise, traffic problems and housing. A report by the Stepney Housing Committee states that the proposal would mean serious interference with work and normal life in the neighbourhood, as well as the demolition of flats housing 800 people. These objections were taken into account at the time of the helicopter stations committee investigation; this committee recommended the St Karine Dock site because it would have good operational characteristics, even if flight were confined for the most part to areas where noise would be less of a nuisance.

QUESTIONS ABOUT SAFETY

SEVERAL questions in the House are likely as the result of the Derby Aviation DC-3 accident coming so soon after the Stavanger tragedy. Mr R. Gresham Cooke (Cons, Twickenham) is to seek a statement from the Minister on safety standards, and is to ask the Minister whether the standard of pilot training and of aircraft maintenance are the same for the independent airlines as for the corporations. Mr. Gresham Cooke describes himself as "slightly alarmed by what seems to be a higher percentage of accidents among the independents than among the big corporations."

The recent DC-3 accident was Derby's first in 22 years of operation, during which just over a million passengers have been carried, and the seventh crash in 10 years in that particular part of the Pyrenees; altogether 85 lives have been lost in these seven crashes. The DC-3 struck Mount Canigou about 6,800ft up, and is thought to have been about 25 miles off course. Mr Roy Mason (Lab, Barnsley) is also to put down a question demanding accident statistics for the independents and corporations (see next page).

A new American operator using London Gatwick as its United Kingdom operating base is Trans Atlantic Airlines, which operates there with DC-4s and this C-46 Commando—quite a rare sight at British airports

THE BRITISH SAFETY RECORD

NO one has ever invented a perfect index for measuring air transport safety, and there are some people—particularly among the independents at this time—who will say that any index is a piece of statistical nonsense. The usual measure is the number of passenger fatalities suffered per so many units of traffic flown; the international index as used by ICAO is number of fatalities per 100m scheduled passenger-miles, an "acceptable" figure being generally regarded as 1.0. (The ICAO figure for 1960 was 1.24, and for 1961 it will be rather higher, perhaps 1.4.)

This index is all right for air transport as a whole; it is when it is used to compare one airline with another, or one group with another, that statistical sensitivities are really aroused. Supposing, for example, that ABC Airways has a series of six accidents in one year in which six aircraft are written off, but from which all the passengers walk away unhurt. This operator will appear to have a perfect safety record; yet if XYZ Airways, a much smaller operator which has never even had a serious incident, let alone an accident, in 20 years (Derby Aviation for example), suffers a tragedy in which everyone is killed, its safety record might appear to be 100—or possibly 1,000 times—worse than that of ABC Airways.

It is worth remembering too that many British independents have never had a fatal accident; that the accidents suffered by Transair, Silver City and Derby Aviation were the first ever to befall these operators; and that during the past few years both BEA and BOAC have had a number of incidents which, but for the grace of God, could have been serious accidents.

It is in this context that any measure of the comparative safety records of the independents and the corporations must be viewed. Nevertheless, because within little more than two years three charter aircraft operated by British independents have struck mountains with heavy loss of life, questions are being asked about the comparative safety records of the independents and the corporations. According to a *Flight* estimate the independents' fatality rate over the past six years or more has been eight times worse than that of the corporations. The usual index of air transport safety, number of fatalities per 100m scheduled passenger miles, is not appropriate for a comparison between the corporations and the independents; while the majority of the corporations' business is scheduled, the majority of the independents' operations are non-scheduled. Furthermore, statistical complications arise in trying to measure on a comparable basis the passenger-miles flown on scheduled and non-scheduled operations by the corporations and the independents. For example, no figures are published by the Ministry for the corporations' non-scheduled passenger-mileage, while such figures as can be extracted from the corporations' reports are for March 31 years and not the June 30 years for which independent figures are published by the British Independent Air Transport Association.

However it is possible, by using Ministry figures for the corporations and BIATA figures for the independents, to measure the total capacity ton-miles produced by the corporations and independents over the years. The table opposite sets out the total c.t.ms carried since June 1955. This is considered to be a reasonably lengthy period over which to compare fatality rates. Because figures are not available beyond June 1960 for independent non-scheduled operations, and beyond May 1961 for corporation and independent scheduled operations, some estimating has had to be done in respect of certain recent figures, as indicated in footnotes to the table. This estimating has, in the case of the independents, been deliberately weighted favourably, and deliberately weighted unfavourably in the case of the corporations. The reason for this is that, even if the estimates are 20 per cent out, the difference between the fatality records of corporations and independents would still be great.

The upper tables show the accidents that have occurred to the independents and the corporations since June 1955—i.e., during the period over which c.t.ms have been compared. During this period the independents (all BIATA) have lost 251 passengers for 1,137,417,000 c.t.ms while the corporations have lost 106 passengers for a production of 3,822,219,000 c.t.ms. In terms of fatality rate per 10 million c.t.ms the figure for the corporations works out at 0.277, and for the independents at 2.21. Thus the independents' fatality rate over the past six years or more has, by this index, been eight times worse than that of the corporations.

Accidents involving passenger fatalities to British airlines on scheduled and non-scheduled revenue services since June 1955

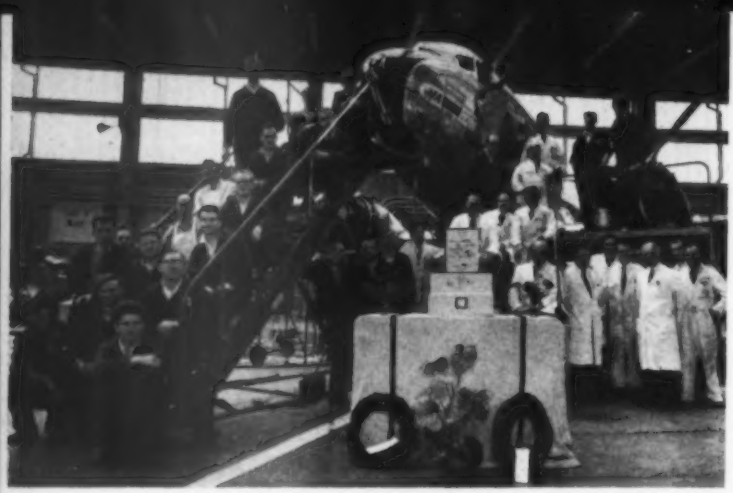
Date	Aircraft Type	Operator	Passenger Fatalities	Location	Circumstances
		Independents			
18.2.56	York	Scottish Aviation	45	Malta	Crashed on take-off
30.4.56	York	Scottish Aviation	2	Stansted	Swung on take-off
5.11.56	Hermes	Britavia	4	Blackbushe	Crashed on approach
1.5.57	Viking	Eagle Aviation	34	Blackbushe	Engine failed after take-off. Crashed on approach
15.11.57	Solent	Aquila Airways	35	Isle of Wight	Crashed returning to Southampton Water
27.2.58	Bristol 170	Silver City	35	Winter Hill	Hit high ground
19.8.59	DC-3	Transair	29	NE of Barcelona	Hit mountain
9.8.61	Viking	Cunard Eagle	36	21 miles NE of Stavanger	Hit mountain
7.10.61	DC-3	Derby	31	Canigou	Hit mountain
		Corporations			
21.10.55	Argonaut	BOAC	13	Idris	Undershot
24.6.56	Argonaut	BOAC	29	Kano	Crashed after take-off
14.3.57	Viscount	BEA	15	Manchester	Crashed on approach
23.10.57	Viscount	BEA	2	Belfast	Crashed on approach
22.10.58	Viscount	BEA	26	Nettuno	Collision
6.2.58	Elizabethan	BEA	21	Munich	Crashed on take-off

Total revenue CTMs flown on scheduled and non-scheduled services

Year ended June	BOAC x 1,000	BEA x 1,000	Independents** x 1,000
1956	267,844	129,995	158,462
1957	287,764	144,415	150,746
1958	344,822	165,905	161,182
1959	385,718	183,760	171,219
1960	508,212	203,784	196,808 *
1961 †	900,000 ‡	300,000 ‡	299,090 ‡
Totals	2,694,360	1,127,859	1,137,417

* Non-scheduled content estimated to be 130,000
† Period June 30, 1960, to mid-October 1961
‡ Estimated
** BIATA

The Polish airline LOT is now operating Il-18s into London Heathrow from Warsaw, the increase in traffic between the two capitals now demanding a larger aircraft than the Il-14s operated hitherto



An affectionate "memorial tribute" to the DC-3 was recently held by BEA maintenance engineers at their London Heathrow base. The occasion was the last overhaul by BEA of a DC-3, a type which has been in continuous service with the corporation since February 1946. BEA's few remaining DC-3s, used for air freighting, will be replaced in November by Argosies

AIR COMMERCE...

THE BIG APPEAL (concluded)

HERE we continue and conclude our summary, published in the previous two issues, of the evidence given at BOAC's appeal against the Air Transport Licensing Board's decision to grant Cunard Eagle a North Atlantic route licence.

MR Fisher, for BOAC, suggested that Mr Gardiner had also been playing a "gramophone record"—of the speech he had made to the Board at the hearing of applications for European services. Little of what Mr Gardiner had said, he submitted, related to the argument heard by the Board, and Mr Gardiner seemed to be trying to manufacture a case out of thin air. Mr Fisher said he would not repeat his opening speech; nothing said by Mr Gardiner had thrown doubt on the correctness of the submissions made, which had been summarized in writing.

Dealing with various points raised by Mr Gardiner, Mr Fisher suggested that it was the duty of BOAC to develop the services which they had powers to provide. The duty of BOAC had always been construed as being to develop world-wide services and the corporation had built up, and intended to maintain, a tremendous national asset. Mr Fisher agreed that the repeal of Section 24 of the 1949 Act gave equal opportunity to apply; who should succeed was controlled, in the absence of evidence on other considerations, by the provisions of Section 2(2) of the 1960 Act. There had been no submission to the Board that they had a duty to grant independents enough licences to enable them to buy jet aircraft and survive, nor was there any indication that the Board had had this in mind.

Mr Fisher said that Counsel for Cunard Eagle had argued that the licence granted was "only a little one." The appeal was a matter of principle, in a case which would help to establish vital precedents, and it must be decided on the evidence in the light of Section 2(2) of the 1960 Act. The traffic results of the last few months, since the Board's hearing of the application, were very relevant as they indicated that this would be the worst possible time to introduce a second carrier on the route. BOAC's financial commitments for the purchase of aircraft, based on the assumption that the Corporation would carry the full British share of the traffic, had had the approval of H.M. Government. The fact now important was that the aircraft ordered were still adequate for the whole British traffic potential.

The three Boeings which had been ordered this year had not been for routes covered by this hearing. BOAC's objection under 2(2)(g) relied on orders placed for Boeings in 1956 and for VC10s and Super VC10s in 1958. "The Boeings we ordered in '61," said Mr Fisher, "have nothing to do with the case." Mr Fisher discounted the advantages of a second operator claimed by Mr Gardiner. One result of the grant might well be that the British aircraft industry would have no customers at all able to place development orders for aircraft like the VC10. It was not true that BOAC had underestimated traffic: their capacity shortages in the 1950s had been caused by the Comet I disasters and shortage of dollars. Progress on VC10s at Vickers' works was on schedule. As for Mr Gardiner's suggestion that BOAC had been mollycoddled, there were 18 highly competitive rivals on the North Atlantic routes and the entry of Cunard Eagle would only make things more difficult for BOAC.

Inter-Governmental agreements might be affected by the grant of a licence and were therefore relevant: no negotiation of rights would be involved so the exercise by the Minister of the guillotine powers reserved to him in Section 2(3) of the Act of 1960 would not have been justified. Nevertheless, BOAC's position under the existing agreement might be adversely affected and their bargaining powers in future negotiations with American airlines prejudiced. An important point was the possibility that America might call for termination or revision of the agreement. Mr Fisher submitted that Mr Ashton Hill had suggested no alternative to the BOAC proposition that British carriers could expect to handle not more than 50 per cent of the total UK and USA carriers' loads. This was, therefore, a reasonable basis on which to assess the capacity that would be justified. Mr Fisher submitted that no evidence had been offered that BOAC's services were inadequate and the Board had conceded that there would be material diversion but had considered it irrelevant.

Wasteful duplication would exist if resources were not being used as had been intended. All the airlines on the North Atlantic could at present accept 40 per cent more passengers without any increase in capacity; unused capacity was wasted capacity and the addition of Cunard Eagle's Boeings in these circumstances would surely be wasteful duplication. Defending BOAC's handling of statistics, Mr Fisher claimed that, when the actual figures for 1960-61 were "cleaned," the error in the estimate was seen to be only 7,000 in 400,000 or less than 2 per cent.

Mr Fisher referred again to the figures submitted by BOAC to illustrate the financial implications of the difference between BOAC's and Cunard Eagle's traffic estimates, to support the argument that the diversion would not be immaterial. He repeated the argument that fare cuts foreseen by BOAC might not now be made, so that traffic increases these cuts—or greater reductions assumed by the Board—might have brought about were unlikely, whereas the trade recession had materialized and traffic increases had been consequently retarded. It was unlikely, in the view of BOAC, that the sales effort of Cunard Eagle, added to that of the eleven carriers already on the route, would noticeably increase traffic.

Taking the seven possible advantages suggested by Mr Gardiner one by one, Counsel for BOAC criticized them in turn (mostly not for the first time!) and pointed out that they were not matters recommended to the attention of the Board in Section 2(2) of the 1960 Act. Asking why Cunard Eagle had not cross-appealed if they were disappointed with the licence awarded, Mr Fisher said he thought they were very lucky to have got anything at all: the Board were wrong to award a licence, having accepted all BOAC's arguments under Section 2(2). In any case, 65,000 passengers carried by Cunard Eagle each year would mean a revenue loss of £5m annually to BOAC and this incursion would seriously damage BOAC's position as the main British flag carrier on world routes. Finally, asking the Commissioner to give the fullest weight to evidence on recent traffic submitted by BOAC, Mr Fisher reminded him that the corporation had made provision for ample capacity to carry the British share of the traffic now and in the future. They were, in fact, proposing to reduce the capacity offered by 7 per cent in 1962-63; surely this was the worst possible moment to introduce additional capacity provided by another carrier.

AIR TRAFFIC CONTROL CADETS

THE MoA is introducing an officer cadet scheme for civil air traffic control. School-leavers with the necessary academic qualifications will be invited to apply for places in a four-year training scheme at the Air Traffic Control School at Hurn. In the past traffic controllers have been largely recruited from men with flying experience, but the traffic service is expanding, and this source is not likely to prove adequate in the future. Moreover, this is essentially a profession that requires, to quote the Ministry of Aviation, "resilience, quick thinking and resourcefulness." To obtain the high standard required and to determine whether a school-leaver has these qualities will mean that a form of selection, possibly on the lines of aircrew selection, will have to be implemented.

Applicants for a cadetship who meet the educational requirements (GCE, with passes in five subjects, one of which must be English and two of which, including mathematics or a scientific subject, must be advanced level) and have the personal qualities necessary, will, after successful interview, undergo full-time training for four years. This will include some flying instruction, and at the conclusion of the course cadets, who will be paid while training, will be promoted to ATC Officers, Grade III. Full details of the scheme are being circulated to schools and education authorities and the first intake into the ATC School at Hurn will commence in February 1962.

Unlike most airlines, who are restraining their enthusiasm for the idea of supersonics, Lufthansa exhibited this model of a Mach 3 airliner at their recent annual meeting in Bonn. The German airline is discussing projects with the US industry, and hopes to introduce supersonic airliners in 1970. A note about Lufthansa's loss in 1960 appears on the opposite page

Appointed air safety officer for Aer Lingus is Commandant Andrew J. O'Shea, AFRAeS, hitherto an Irish Air Corps technical officer

LUFTHANSA MAY LOSE £14m

FURTHER details are now available of Lufthansa's loss of DM39m (£3.5m) during 1960 (*Flight*, October 5). Of the DM39m made up by Government subsidy, DM20.3m was provided to cover special depreciation on propeller aircraft made obsolescent by the introduction of jets. It is reported that Lufthansa expects its operating loss this year to be something like four times as great— that is to say about £14m.

Herr W. A. Kittel, a member of the board, is said to have regretted the "fly American" campaign in the US, which has adversely affected Lufthansa's all-important North Atlantic business. Dr H. J. Abs, chairman, has said that in the second quarter of this year the airline sold 49 per cent of the seats offered on the North Atlantic route compared with 66 per cent in the same period last year.

On the question of Air Union, Dr Abs says it is "quite untrue" that the plan is dead or that it will be "watered down out of all recognition." Air Union, he says, must be so constituted that it will increase the share of all its partners in world air transport. These are the first words spoken in public by one of its members for some time about Air Union, which has appeared to be dormant for some 12 months or so. Whether there proves to be any foundation for Dr Abs's optimism, or if the other Air Union partners share his views, remains to be seen.

AIRLINER MARKET PLACE

THE Boeing Stratocruiser has not entirely disappeared from airline service, and a reminder of this is provided in the current range of Air-Britain publications in which is recorded the acquisition of an ex-PanAm Stratocruiser by the recently-formed Ecuadorean carrier Linea Internacional Aerea SA, possibly for this airline's Guayaquil-Quito route. The Flying Tiger Line has leased an L.1049H Super Constellation to Trans-International Airlines Inc, a Florida-based "non-sked," and Northwest has sold a DC-7C to President Airlines, who have named it "Franklin Roosevelt."

Air forces, as well as charter and non-scheduled operators, are in the market for surplus piston-engined transports, as is emphasized by the recent sale by PanAm of three DC-6Bs to the Portuguese Air Force, and one of the two DC-6Bs of Jugoslovensky Aerotransport (JAT) has been sold or transferred to the Jugoslav Air Force. Some unreported DC-6B sales in recent months include single examples of this type from American Airlines to Lloyd Aero Boliviano, from United to United States Overseas Airlines and from SAS to Kar-Air O/Y. Continentale Deutsche Luftreederei, the German independent, has leased a DC-6B from UAT and acquired an additional DC-4 to supplement the three DC-4s it already has, while American has sold a DC-6 to Compania Ecuatoriana de Aviacion—CEA. The Ecuadorian carrier AREA has acquired a DC-4 from Northwest, while PanAm has sold an aircraft of this type to Trans-Mediterranean Airways.

Straits Air Freight Express has acquired two ex-Pakistani Air Force Bristol Freighter 31s to add to the five of this type they already own, while the rapid growth of Japanese domestic air transport has resulted in the formation of several new carriers. One of these is Fuji Airways, which has acquired an ex-Garuda Heron 1B through C. Itoh & Co, while another, North Japan Koku KK, acquired two Convair 240s from Mohawk, while All Nippon Airways has acquired two more Convair 440s, bringing its fleet of this type to five.

BOAC STRIKE REPORT

THE report of the committee of investigation inquiring into the 12-day strike of BOAC maintenance workers in July was issued last week. The strike, it will be recalled, started when the management introduced a new supervisory system. The six-man committee, consisting of four union representatives and two from BOAC, was set up by the National Joint Council for Civil Air Transport, and after a full and penetrating survey has made a series of unanimous recommendations; in the course of seven meetings the committee heard evidence from 31 witnesses and considered 31 letters.

Some of the recommendations are worth recording as they could materially alter and improve relations between management and workers. The report generally appears to favour the new supervisory scheme but the recommendations point to lack of communication between management and staff. In general the committee considers that no group of workers has been adversely affected by the new system, and it counsels the workers' representatives "to ensure that the information they report is distinct from the opinions they personally hold."

The report also criticizes union leaders for failing to pass on full information to the workers. Other points made by the report concern choice of supervisors, licence training, promotion, and clerical assistance for the new supervisors. On the latter, the report recommends the corporation to try and devise means of reducing paperwork both in the workshops and on the hangar floor. Members of the committee were Mr J. Hendy of the ETU, Mr G. Bone of the AEU, Mr Ian Mikardo and Mr Clive Jenkins of ASSET, Mr R. C. Amoore and Mr L. Atherton of BOAC.

OVERSEAS WOUND UP

FOLLOWING the voluntary liquidation of Overseas Aviation Engineering (GB) Ltd, which showed unsecured liabilities for £147,211 due to 385 creditors (see last week's issue), the compulsory winding-up of the "operating company," Overseas Aviation (CI) Ltd, was ordered in the High Court on October 9. The winding-up was ordered by Mr Justice Buckley on the joint petition of BP Trading Ltd and Rolls-Royce Ltd. The petitioners' counsel said that they were owed £509,000. The claim of BP Trading Ltd was not accepted because there was a claim outstanding for substantial damages against BP Trading Ltd for breach of contract.

Mr J. G. Stoneman, QC, for a shareholder, Mr Ronald Myhill, who is chairman of Overseas Aviation Ltd, said he was also a creditor. The making of a winding-up order was not opposed. Mr M. Jacomb, who was counsel for Rolls-Royce and BP Trading, also represented supporting creditors, BOAC for £109,000 and WAAC (Nigeria) Ltd for £13,000. Further details of the company's financial position were given in *Flight* for August 24, page 269.

Bankruptcy proceedings against Overseas Aviation (CI) Ltd, which went into voluntary liquidation in August, were to have been heard in Jersey last week. The proceedings were instituted in Jersey on August 26, when the action was brought by WAAC (Nigeria) Ltd. At the time the court was told that there were no fixed assets in the Island and no money was in the bank. WAAC (Nigeria) Ltd therefore withdrew their claim.

Seen recently at Luton Airport, Autair's main operating and maintenance base, is one of this independent's DC-3s. The DC-4 belongs to Trans-Mediterranean Airways, who now use Luton rather than London for their freight flights out of the UK. This new independent is handled at Luton by Lutair, an Autair company

Seen here at Beirut is an ex-MEA Viscount of Jordan's new national airline, whose formation was recorded in our October 5 issue. At present the two DC-6Bs, one DC-4 and one DC-3 of Air Jordan, whose services were suspended last month, are parked immobilized at Amman airport

AIR COMMERCE...

BRITISH RAILWAYS v. BEA

UNTIL recently British Railways had been puffing along from one annual deficit to another, apparently unaware of the competition that was mounting in the air. A classic illustration of this was last year's monumental Parliamentary Select Committee enquiry into the railways; hundreds of thousands of words of evidence given to that committee included only one fleeting reference to air transport.

However, in contesting BEA's application to operate unlimited-frequency 3gn night fares to Glasgow, Edinburgh and Belfast from November 1, British Railways showed that they are now fully awake to the threat of air competition. Unfortunately, all the odds are against the railways. First, they cannot reverse or halt the inevitable progression of surface v. air transport history—recent history in which the airlines have driven the US passenger-carrying trunk railways into bankruptcy, and beaten the North Atlantic shipping lines to their knees. Second, they have no champion in the Air Transport Licensing Board, which is the only tribunal before which they can fight air competition. Although this Board is required to hear British Railways' objections, its duty, as everyone knows, is to "further the development of British civil aviation."

Nevertheless, British Railways put up a strong flight at the hearings into BEA's application, which began on September 15 and were resumed and concluded on October 6. Mr E. S. Fay, QC, for the British Transport Commission, said that this was the first proposal by BEA to undercut a second-class rail fare. British Railways were not against competition, but felt that fares should be related to the service provided. Mr Fay objected to BEA's pricing of the proposed fares on marginal costing, rather than on average costing. Previously, Mr Henry Marking, for BEA, had indicated that the proposed services were intended primarily for mail and newspapers, with passengers contributing extra revenue. Timings of the flights, leaving London at 1130hr and 1140hr, were dictated by the requirements for mail and newspapers.

The members of the Board were curious about railway passenger statistics, and at British Railways' consistent inability to produce such statistics. The Board were anxious to have some figure—5,000, 5m or 500m—on which they could assess the probable impact of the BEA proposals.

Mr Marking, for BEA, suggested that British Railways would have a case only if they could show that the proposed BEA services would be uneconomic, and hence not in the interests of British civil aviation. BEA were satisfied that this would not be the case, and were prepared to supply confidential costing figures to the Board if required to do so. In his summing up for BEA, Mr Marking observed the Act, in defining the Board's duty to further the development of British civil aviation, did not add "so long as that does not harm British Railways."

A point of great significance was made by Mr Fay, for British Railways. Where the interests of air and surface operators conflicted, he said, there must be some body competent to decide the issue from the point of view of the public interest. If the Board did not do this the British Transport Commission might seriously have to contemplate the promotion of new legislation in Parliament.

IATA IN 1960

THE fifth edition of IATA's *World Air Transport Statistics*, for the year 1960,* is now available. It shows that in 1960 IATA's 88 members carried 82.4m scheduled passengers 36,300m passenger-miles, an increase of just over 10 per cent, at an average load factor of 60.3 per cent. The average number of seats per aircraft rose from 34.7 to 39.2 and average block speed from 230 to 240 m.p.h. IATA membership increases from year to year (87 carriers submitted operating statistics in 1960 and membership in July of this year was 92), so that development is best measured by comparing traffic of airlines that were members in 1959 and 1960. This is why only 84 airlines' statistics are compared in the table.

On the North Atlantic a total of 1,919,750 passengers and 44,700 tons of cargo were carried, increases of 24.7 per cent and 28.7 per cent respectively. The number of flights, 32,257, decreased by 2.6 per cent, due to the large-capacity jets introduced during 1960. IATA's charter passenger traffic showed a decrease, the number of charter passengers dropping by 7.9 per cent to 158,978; cargo carried on charter flights decreased by 78 per cent to 760 tons.

For the first time statistics are given for the eight IATA member airlines operating on the South Atlantic route. Passenger traffic increased substantially by 45.9 per cent to 70,168 passengers, while cargo increased by 23.9 per cent to 942 tons. Average load factor for the year was 69.6 per cent.

**Published by IATA, 1060 University Street, Montreal. Price 50 cents*

SCHEDULED TRAFFIC FOR 84 IATA MEMBER AIRLINES

	1959	1960–	± per cent change
*Revenue miles	930	910	− 2
†Revenue hours	6,573	6,135	− 7
†Revenue passengers	76,371	81,872	+ 7
*Revenue passenger-miles	32,770	35,900	+ 11
*Available seat-miles	52,600	59,400	+ 13
Revenue passenger load factor	61.6%	60.4%	− 1.2
*Revenue load ton-miles:—			
Passengers	4,648	5,168	+ 11
Excess baggage	62	65	+ 4
Freight	969	1,088	+ 12
Mail	300	365	+ 22
Total	5,979	6,686	+ 12
*Available ton-miles	10,180	12,000	+ 15
Revenue load factor	57.8%	55.9%	− 1.9

* In millions † In thousands

Footnote: *Hopes that IATA traffic on the North Atlantic would pick up in August do not appear to have materialized. Scheduled airlines carried 237,468 passengers during August, an increase of only 2.2 per cent compared with August 1960. Passengers load factor decreased by 16 points to 52.4 per cent.*

BREVITIES

Lord Balfour of Inchrye, PC, MC, a member of the board of BEA, is to deputize for Lord Douglas at the IATA annual general meeting which begins in Sydney on October 23. Capt J. W. G. James and Mr Henry Marking of BEA will also attend the meeting.

According to *Interavia*, Panair do Brasil is negotiating a contract with Sud Aviation for one or more Caravelles.

Manchester United Football Club is suing BEA for £250,000 damages in respect of the accident to the BEA Elizabethan at Munich in February 1958.

The Minister of Aviation has reappointed Lord Rennell of Rodd as a part-time member of the board of BOAC for a period of three years to November 20, 1964.

Ministry of Aviation staff and equipment will be withdrawn from Squire's Gate Airport, Blackpool, within the next six months. This withdrawal will take place whatever the outcome of present negotiations between the Ministry and Blackpool Council over Squire's Gate.

Air Couriers Ltd, engaged in aircraft engineering at Biggin Hill, has acquired a 50-year building lease in Gatwick's maintenance area where it has a substantial engineering base in course of construction. The Eagle Star Insurance Co Ltd has acquired an interest in Air Couriers.

Ozark Air Lines has purchased four Convair 240s for use on routes between Joplin, Springfield, St Louis and Chicago.

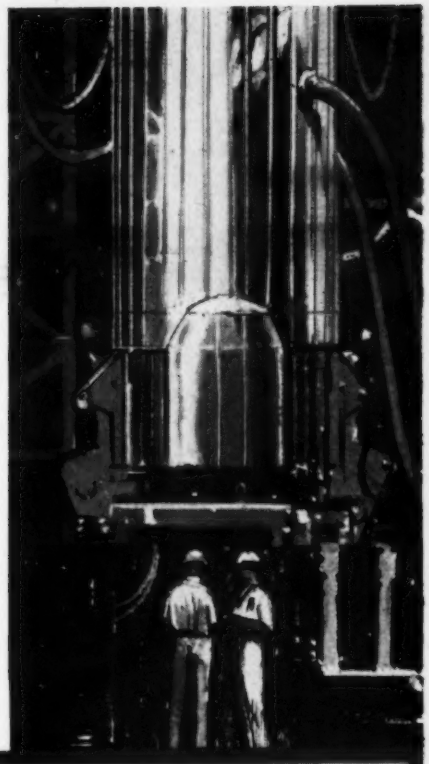
The resignation of James T. Pyle as Deputy Administrator of the FAA has been accepted by President Kennedy.

Air France has now placed a firm order for four more Boeing 707-328Bs, bringing its 707 fleet up to 24.

Aer Lingus made a record operating surplus of £500,000 in the half-year ended September 30, of which £320,000 was earned on the Atlantic route and £180,000 on European routes. Mr J. F. Dempsey, general manager of Aer Lingus, described the Atlantic results as "really spectacular."

The Ministry of Aviation is to carry out a periodic census of all civil air traffic flying in the London, Preston and Scottish Flight Information and Upper Flight Information Regions. All classes of British and foreign aircraft will be included. The first census will take place during the week beginning December 4.

The September issue of *Firemen*, the magazine of the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass, contains an article discussing the fire hazard characteristics of kerosine, Avgas and JP-4. The conclusion is that kerosine offers a slight safety advantage over other aviation fuels.



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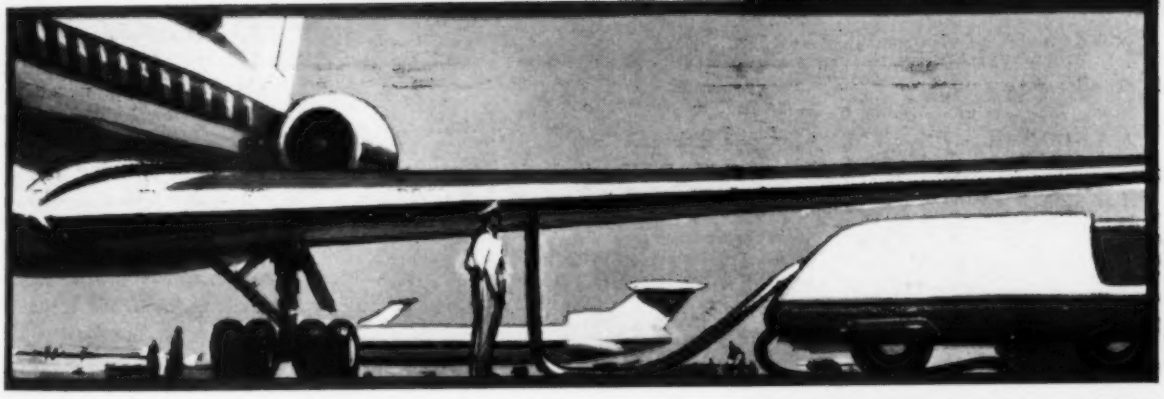

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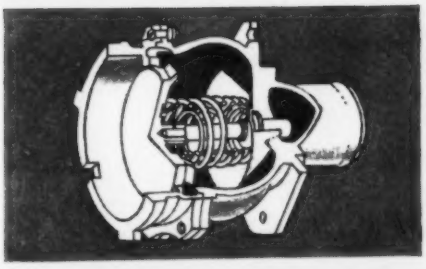

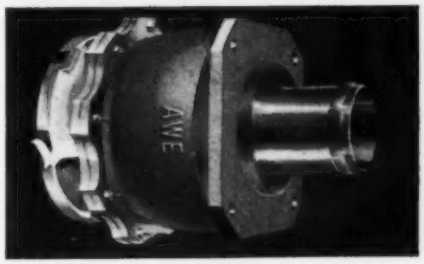

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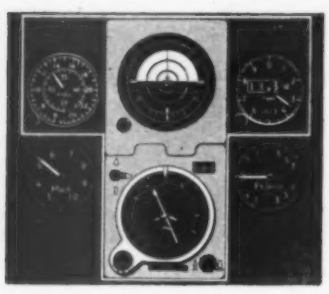

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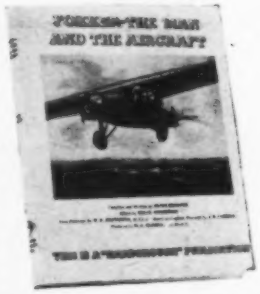

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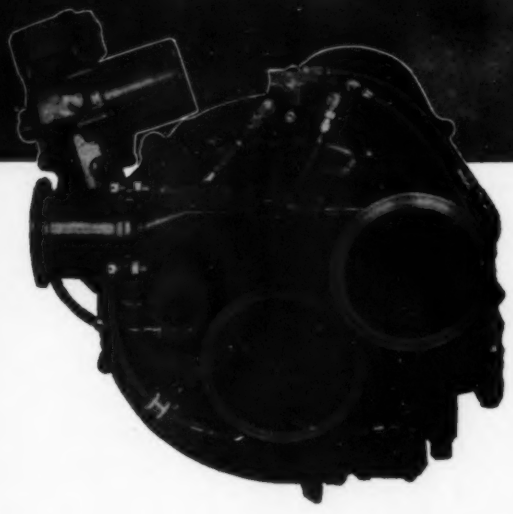

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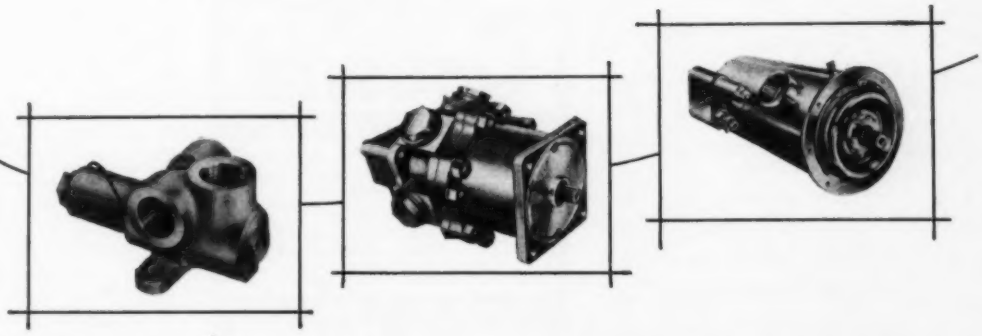

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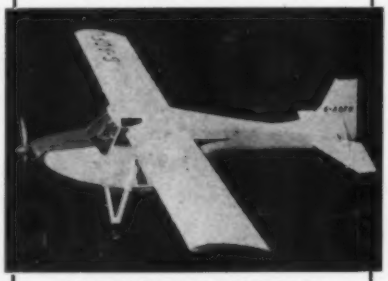

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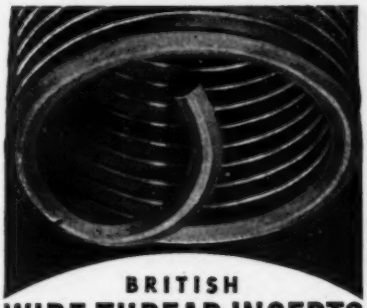

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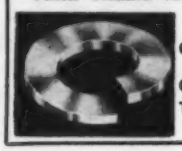

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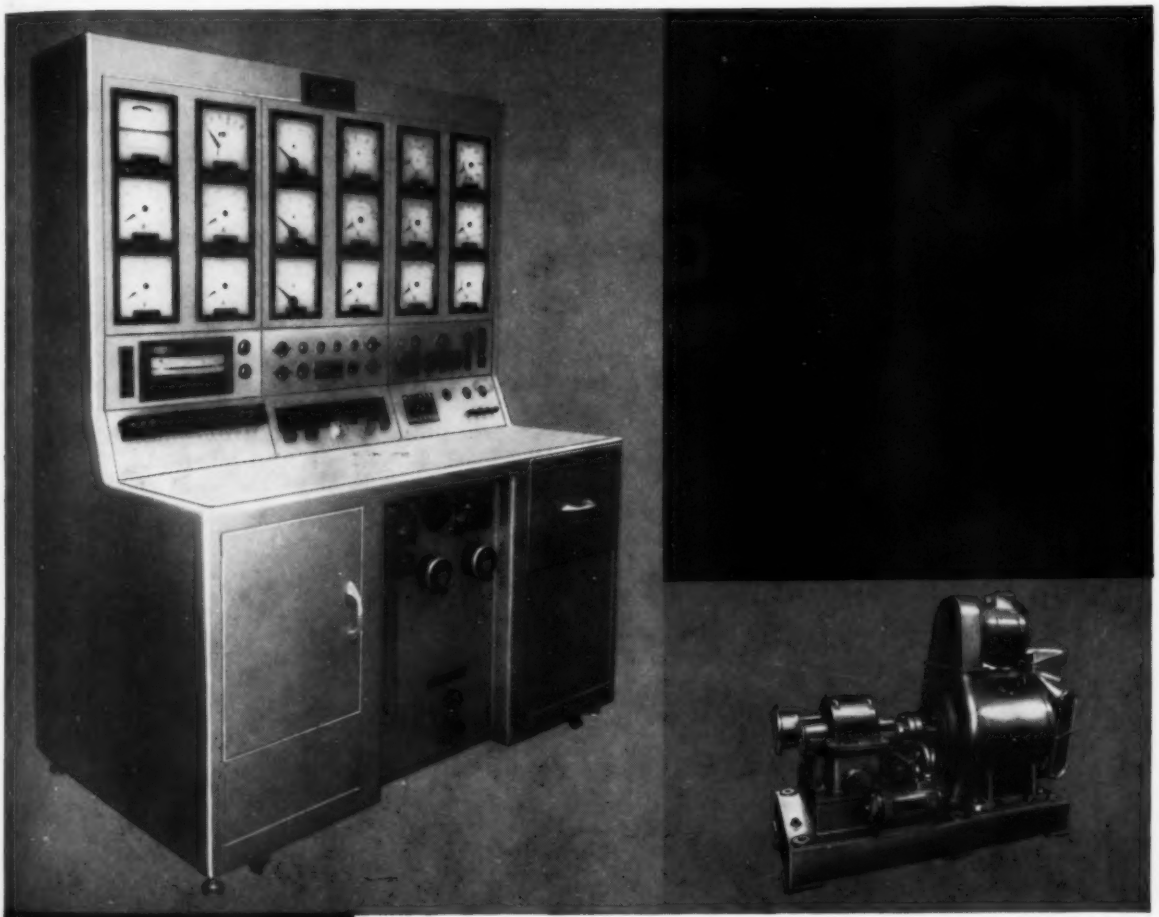

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